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THE TELEGRAPHIC JOURNAL AND
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Vol. XVI.—No. 394.

OVERHEAD WIRES.

After all no immediate effect is to result from the labours of the Committee on Overhead Wires whose sittings terminated about a month ago, and whose report appeared in the Review of May 16th. The condition of Parliamentary affairs and the position of the existing Government has of course for some time precluded any expectation of initiatory measures from the Government itself on a matter regarding which the general public may be said to be comparatively ignorant or indifferent. But at least it might have been hoped that it would not attempt to damn the chances of future Bills on the subject by giving expression to such needlessly decisive and antagonistic views. The Government, according to the Press Association, does not intend to follow up the report of the Select Committee by any legislation, and has placed the slight upon that Committee of stating that it considers the recommendations made impracticable and tending to invade private rights to an extent for which it cannot make itself responsible. The cry of an invasion of private rights is no doubt a safe and a powerful one; but it is also one which it is often convenient to forget, and there are instances on record where private rights, and public rights too, have been ignored to a much greater degree than is proposed under the suggestions of the Select Committee, when it has seemed politic to Ministers or to Governments to introduce and pass this Bill or that.

The question which naturally occurs now is, what is to become of the United Telephone Company's Bill for an extension of its powers? Although the committee decided not to take that Bill into consideration, we may rest assured that its progress has been stayed pending the results of the committee's sittings. Under the circumstances we cannot see much hope for it at present, and can only imagine that it will be withdrawn, to be re-introduced at a future and more favourable opportunity. At the same time, we recognise that it is a matter of some urgency, so far as the United Company is concerned, for the company is naturally anxious to avail itself as quickly and as extensively as possible of the powers it has newly-acquired from the Post Office, and in this aim it will be considerably impeded by the difficulties which it will have to encounter in the running of its wires and in various other ways, regarding which help from fresh legislation had been hoped for.

One thing at least we may be thankful for, that things will be left as they are and not made worse. In these days, when "demonstrations" are so freely made upon matters sometimes important, sometimes trivial, and when interested agitators find such little difficulty apparently in persuading an all too credulous populace that veritable mole-hills are prodigious mountains, it is something that a cue has not been taken from some of the American authorities, who have so far ignored all considerations of practicability and common sense as to enact laws inexorably relegating electric wires to a subterranean existence. It is a curious point in connection with these laws that they have led to serious complications closely affecting the authorities themselves, whose fire-alarm and other similar services, if the laws were rigidly adhered to, would equally suffer with the electric lighting, telegraph and telephone companies'. In some cities the electric corporations have felt sufficiently strong in their cause to defy the authorities and refuse altogether to bury their wires. The "war" between the parties is still raging, and we can only hope that common sense will in time prevail, in England as well as in America, and the foolish objections to overhead wires be withdrawn.

INDICATOR DIAGRAMS.

In many instances when experimenters have wished to ascertain the percentage of horse-power developed by an engine which is transformed into electrical energy in a dynamo, the indicator diagrams given by the engine have been used to calculate the mechanical horse-power. We have never had much faith in the results of tests obtained by such a method, and the following abstract of a paper "On the theory of the indicator and the errors in indicator diagrams," read by Professor Osborne Reynolds at the Institution of Civil Engineers, on the 19th ult., goes far to support us in our views.

Prof. Reynolds said the object of his paper was to define the causes and extent of the disturbances in indicator diagrams. The theory, as given, had been taught for several years in Owens College; but the publication had been deferred to enable an extensive series of experiments to be made. These experiments had now been carried out by Mr. A. W. Brightmore, Stud. Inst. C.E., late Berkeley Fellow in Owens College. In the first place it was shown that there were five principal causes of disturbance, namely, the inertia of the piston of the indicator and its attached weights; the friction of the pencil on the paper, and its attached mechanism; varying action of the spring; inertia of the drum; friction of the drum.

The effect of the inertia of the pencil and its attached mechanism presented a mathematical problem, by the solution of which it was shown that there were two disturbances from this cause; one, a general enlargement of the mean indicated pressure, depending on the weight of the moving parts of the indicator, the stiffness of the spring and the square of the speed. The other disturbance was a vibration of the pencil. Every indicator piston vibrated when disturbed, so that the period of vibration depended on the stiffness of the spring.

The error which these oscillations caused in the area of the diagram depended on their magnitude, and, to a greater extent, on the smallness of the number in a revolution. But the evil of these oscillations was not so much an effect on the area, as in the disfigurement and the confusion they produced in the diagram. So long as there were 30 of these oscillations in a cycle, the necessary fluid friction of the indicator piston would so far reduce them as to render a fair diagram possible, but when the number was as low as 10 it was all the pencil could do to prevent them upsetting the diagram.

The friction arising from the pressure of the pencil always acted to oppose the motion of the pencil, and therefore rendered it too large during expansion and exhaust, and too small during compression and admission, and thus the general effect was to increase the size of the diagram. This friction consisted of that of the pencil on the paper; and that of the mechanism, caused by sustaining the pressure of the pencil. The effect of the friction of the pencil was greatly reduced by the motion of the paper. The magnitude of these effects taken together on the area of the diagram depended on the construction of the instrument and on pencil-pressure. From numerous experiments it would appear possible to make a difference of as much as 5 per cent. in a locomotive in mid-gear by pencil-friction.

The conclusions, as regarded the motion of the pencil, were that the general effect of inertia and friction were both to increase the size of the diagram; that so long as the speeds were such that the number of vibrations of the pencil during a revolution of the engine was not greater than 15, the effect of inertia was less than 1 per cent., but that if the number was greater than thirty, oscillations would show themselves unless the pencil-friction was increased. They might, by this, be kept down till the number of vibrations was equal to 15, but not farther, and then the necessary friction would affect the area of the diagram about 5 per cent. For the diagrams to be sensibly accurate, and free from oscillation, the speeds must not be greater than would make the number of vibrations equal to 30. These speeds were given in the paper for Richards's indicators.

The effect of the inertia of the drum with an elastic cord was shown to be a nearly uniform elongation of the diagram. The result of the varying stiffness of the drum spring was a nearly uniform contraction. With Richards's indicator these two latter disturbances neutralised each other at a speed of 150 revolutions per minute. At other speeds the effects were apparent in the length of the diagram; but except when the expansion was great and the connecting rod short, they did not affect the indicated pressure. The friction of the drum with an elastic cord caused the cord to be longer during the forward stroke than during the backward stroke, so that the diagram was distorted and shortened, the drum being uniformly behind its proper position during the forward stroke, and before its position during the backward stroke. This distortion diminished the area of the diagram according to the rate of expansion and the length and elasticity of the cord used. This was definitely expressed by a formula. This disturbance, the influence of which was very great in cases of high expansion, large engines, and ordinary cords, appeared to have been unnoticed. The circumstances on which it depended were the elasticity of the cord and the friction of the drum, and the question was how far these existed in the ordinary indicators. It might be said that the diagrams which led to the discovery of this effect were taken with an indicator which had been in constant use for several years. It was in apparently perfect condition, and the diagrams did not differ essentially from those which had been previously taken. The cord was one which had been supplied by the maker. The manner of the discovery was described: For years the author had pursued in the class the method of testing the vibrations of the indicator pencil by projecting them on to the crank-circle, and he had noticed that the first oscillation fell short, and shorter in the back diagram than in the front. The cause of this was not obvious, and it was partly with a view to determine this cause that Mr. Brightmore's investigation was commenced. A slight error in the reducing rod, which had a fixed centre and a slot in which a stud in the slide-block worked, was altered. This, however, did not get rid of the effect. A new cord was substituted for the old one, and the effect was found to be much enhanced, the new cord being more elastic than the old one. This reduced it to the stretching of the cord, but it was only after carefully working out the effect of the inertia of the drum, and it was seen this was to lengthen the first oscillation at the back end that the friction was examined. The indicator was taken to pieces, cleaned and oiled; then the effect was much reduced. Several new wires and cords were used, and eventually steel wire was adopted as the best. The test supplied by the oscillations could only be applied to diagrams taken at high speeds, and the test furnished by the influence upon area was vague. What was wanted was an independent means of determining the simultaneous positions of the drum and the engine-piston. As the best method of meeting this, it was decided to arrange an electric circuit through the pencil to the drum, with sufficient electromotive force to prick the paper, making the engine-piston close this circuit at eleven definite equidistant points in the motion backwards and forwards. This was successfully carried out, and the stretching of the cord during the backward and forward strokes was definitely ascertained. Taking the smallest results obtained with a cord, it appeared from these experiments that the least difference of stretching was to make this difference in inches 5 per cent. of the length of the cord in feet. Examples of this effect in diminishing the mean indicated pressure were given. Thus, in a locomotive cutting off at one-quarter it was 8 per cent.; in a condensing engine having 3·5 feet stroke, cutting off at one-tenth, 20 per cent.; and the same compounded, 10 per cent.

These would seem to be the smallest results that could have occurred in ordinary practice. The conclusion, however, that hitherto the normal indicated power from engines had been from 10 to 20 per cent. too small must wait for verification. Yet there were not wanting independent evidences of such an effect. In diagrams taken from engines at high speeds the admission line would not but for this effect be vertical. It would show a certain amount of detail, and the first oscillation would not have a sharp top. Moreover, it was commonly found that the expansion line, allowing for clearance, was above the true expansion line for the steam. This apparent rise in the curve of expansion was exactly what would result if the apparent cut-off was too early, and this was the result of the effect that had been considered The author had tried several diagrams, and found that after correction the expansion line came out very close to the true curve.

In making these comparisons the explanation of another feature of diagrams became apparent. When the two diagrams were traced on the same card, there was sometimes a want of symmetry about them, and in this case the cut-off was shorter on the back than on the front diagram. This the author attributed to the friction of the drum when the cord for the back diagram was longer than that for the front. When this was the case the relative lengths of the cord were about 1 to 1·8. These observations were illustrated in a diagram from "Richards's Indicator." To test this diagram a tracing was taken, and reversed so that the front diagram was superimposed on the back. It was observed that the diagrams were of different lengths, and the difference was about the same as the difference in cut-off; that notwithstanding the apparent cut-off in the back diagram was to that in the front in the ratio of 2 to 3, the expansion line of the back diagram was the same shape as that in the front; and that if the diagrams were restored, supposing the lengths of the cords used to have been 5 feet and 9 feet, the diagrams became exactly similar, and, allowing 2 per cent. clearance, the expansion line came to be the true expansion line for that cut-off. The mean pressure was 14 per cent. larger than from the original diagram.

Such instances as these seemed to sufficiently establish a case against the blind faith which appeared to be at present placed in the accuracy of the indicator diagrams. But in conclusion, the author stated that he should be very disappointed if anything in this investigation should have the effect of diminishing reliance on the indicator itself. He would have the instrument treated fairly, and instead of being the object of unthinking worship he would have it the object of careful study and experimental investigation, so that the limits of its wonderful perfection might be known exactly, and that reliance placed on it which sprang from knowledge.

ON A NEW FORM OF WHEATSTONE'S BRIDGE.

By J. W. GILTAY, of Delft.

IN the following lines (first published in *Zeitschrift für Instrumentenkunde*) I wish to give the description of an apparatus intended for executing determinations of resistances in cases where the observer has at his disposal only one plug rheostat and a galvanometer not arranged as a differential instrument.

As it is well known, we may, in such cases, use that form of the bridge in which an extended metal wire, generally 1 metre in length, can be divided into two parts by means of a sliding contact. These apparatus generally give very inaccurate results, of which the inevitable inequality of the measuring wire is the cause.

The apparatus which I construct depends on the following properties of Wheatstone's wire combination. Let p, q (fig. 1), be an extended wire, and let us select

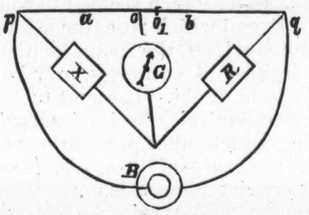


FIG. 1.

the point, o, about in the middle of this wire. Let the resistance of $p\,o = a$, that of $o\,q = b$. Let R be the plug rheostat, X the resistance to be determined, B the battery, and let us assume that the galvanometer, G, indicates no current if a resistance, R_1, is inserted into the rheostat, then :

$$\frac{R_1}{X} = \frac{b}{a} \qquad (1)$$

If the resistance, X, is put in place of the rheostat and the rheostat in the place of X, then if a is not exactly equal to b the galvanometer will indicate a current. If R_2 is the resistance of the rheostat required to leave the galvanometer at rest, then :

$$\frac{R_2}{X} = \frac{a}{b} \qquad (2)$$

If we multiply together the two equations, 1 and 2, we have :

$$\frac{R_1\,R_2}{X^2} = 1,$$

whence

$$X = \sqrt{R_1\,R_2}.$$

As a and b do not occur in the value found for X, it follows that this measurement may be made with any wire whatever, so equality of hardness, of diameter, &c., being transposed. If the point, o, is now transferred to o_1, we have in the same manner :

$$X = \sqrt{R_3\,R_4},$$

where R_3 and R_4 are the resistances of the rheostat now required. The accuracy of the measurement may be judged from the agreement of both results.

This method can certainly not be applied for the measurement of resistances which are greater than the total rheostatic resistance at disposal. The same is the case if a differential galvanometer is used.

Fig. 2 gives a view of my instrument as seen from above. Upon a board of about 20 centimetres in length and breadth there are three separate arrangements :—

1. A plug commutator.
2. A double contact key.
3. A contact changer.

The plug commutator consists of four strong bars of brass or copper, 1, 2, 3, 4. If the two conical plugs belonging to this commutator are inserted in the holes, a and c, then 1 is connected with 3 and 2 with 4. If the plugs are fixed in a_1 and c_1, then 2 is connected with 3 and 1 with 4.

The double contact key consists of a spring, A A, fixed on the one side to the brass block, C, which lies on the board, and fitted at its free end with the knob, D, of vulcanite. On pressing the knob, D, the spring, A A, is forced downwards, and makes contact with the brass plate, E. Beneath the spring, A A, and forming with it a right angle, is a second spring, L, which at its right end is secured to the board, and is at the other end above a metal plate, K, but without touching it. The spring, A A, has on its under side a vulcanite rod, which presses upon the spring L. As soon as A A is pressed down, the spring, L, is carried with it, thus making contact with the plate, K, whilst the contact between A and E is a moment later.

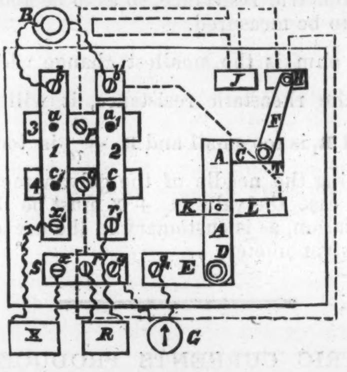


FIG. 2.

The contact changer consists of the arm of a lever, F, which turns on the pivot, T, and is connected with the block, C, and also with the spring, A A. This arm can be laid at pleasure upon the plate, H (as in the figure), or on J.

By means of two wires fixed beneath the board the block, b_1, is connected with the spring, L, and the bar, 2, with the plate, K. These wires are indicated in the figure by dotted lines.

The ends of the wires which were called p, q, in fig. 1, are connected with the screws, p and q, in the middle of the bars, 3 and 4. This wire, of nickel silver, and about 0·3 mm. in thickness, passses from p to the plate J, from J to H, and from H to the clamp, q. It is on the under side of the board, and for the sake of distinctness it is expressed in fig. 2 by dotted lines. The length from p to J is about 46 centimetres, from J to H 10 centimetres, and from H to q 44 centimetres. Lastly, the board supports a metal block, S, on which are three clamp screws, x, r and g.

To measure a resistance with this apparatus the following connections are made :—

The pole of the battery, B, with $b\ b_1$; The rheostat, R, with $r\ r_1$; the resistance, X, to be measured with $x\ x_1$; the galvanometer, G, with $g\ g_1$.

We now fix the plugs of the commutator in a and c, and let the arm, F, rest on the plate, H. If the key, A A, is pressed down, the battery contact is closed between L and K, and a moment after the bridge contact between A and E. By this arrangement we avoid extra currents in the galvanometer.

Let R_1 be the rheostatic resistance which must be introduced in order that the needle of the galvanometer may remain at 0° after the key has been pressed down The plugs are removed from a and c and introduced into a_1 and c_1, whereon the rheostat changes places with the unknown resistance, X. We then bring the rheostatic resistance from R_1 to R_2 in order to keep the galvanometer at rest. From the values R_1 and R_2 it follows that

$$X = \sqrt{R_1\,R_2}.$$

In order to effect a check measurement we transferred the point o to o_1, and thus obtained the values

R_3 and R_4. This is effected very simply in our instrument by turning the lever, F, from H to J.

If the most accurate results are to be obtained by means of Wheatstone's bridge the galvanometer resistance, r, must be so selected that:

$$r = \frac{(a + X)\ (b + R)}{a + X + b + R}$$

where a, b, R and X have the same meaning as in fig. 1.

If X amounts to several ohms, a and b may be disregarded in this formula, and as X and R are not very different from each other, X may be substituted for R. whence:

$$r = \frac{X^2}{2\,X} = \tfrac{1}{2}\,X.$$

We must, therefore, in using this instrument, select the galvanometric resistance, so as to be about half the resistance to be measured.

When $\frac{1}{a}$ ohm is the smallest change which can be made in the rheostatic resistance, it will sometimes appear that R_1 is too small and $R_1 + \frac{1}{a}$ is too great in order to bring the needle of the galvanometer to rest. In such a case the value $R_1 + X$ must be determined by interpolation, as is customary in the use of the differential galvanometer.

ELECTRIC CURRENTS PRODUCED BY RHEOSTATIC MACHINES.

By GASTON PLANTÉ.

THE flow of electricity obtained by means of the rheostatic machine, discharged in quantity, presents peculiar features, and permits of the production of effects which cannot be obtained either with voltaic electricity or with the ordinary apparatus of static electricity.

These effects are at once mechanical and thermic, but the mechanical action is much more important than the thermic action. I have previously mentioned the nodes of vibration formed in a fine platinum wire ($\frac{1}{20}$ millimétre) traversed by this current, and which appear at almost regular intervals, presenting themselves in the form of acute angles with junctions connecting. The distance between these folded parts of the wire varies with the electromotive force of the current; if the wire is shortened it distorts itself completely, twists and untwists upon itself in all directions, and at last breaks spontaneously, though not strained.

If we cause this current to act upon a thin condenser of sheet mica, which may be perforated on account of the high tension which comes into play, the phenomena differ entirely from those manifested when a secondary battery of 800 couples acts alone upon such a condenser. There is here no longer produced a wandering electric spark, nor a globule of fire from the melted tin and mica of the condenser. We have a continuous series of brilliant sparks at the same point, and the mica, instead of being melted, is reduced to small lamellary fragments and projected around the condenser, forming a small artificial hail of micaceous spangles. Thus the effect manifested is especially mechanical, instead of thermic, and we have a fresh instance of the variety of phenomena which electricity may produce according to the nature of the source whence it emanates.

If we introduce a platinum wire in connection with one of the poles of the rheostatic quantity machine into a capillary tube open at its two extremities, and if we immerse one of these extremities into a vessel of salt water, the other pole of the machine being in connection with the liquid, sparks attended by a peculiar harsh sound appear at the extremity of the tube. To each spark there corresponds an abrupt leap of the liquid in the tube, and as these sparks follow each other with an extreme rapidity, the liquid, not having time to re-descend, is raised incessantly by jerks to a height of 0·15 to 0·20 metre, according to the electromotive force of the current. We have thus a real image of the effects of the hydraulic ram, produced by a mechanical action due to electricity. Among the numerous analogies which exist between the phenomena produced by electric currents of high tension and the effects produced by mechanical actions properly so called this is assuredly one of the most striking.

This experiment enables us to explain a very singular natural phenomenon manifested during a violent storm, accompanied by rain and hail, on July 30th, 1884, at Ribnitz, in Mecklenburg-Schwerin, and which, being as far as is known without precedent, has appeared totally inexplicable. The lightning having fallen upon a dwelling house, one of the panes of a window of a room on the first floor was pierced by a starry hole, and at the moment of the appearance of the lightning there was perceived the sudden irruption of a great quantity of water which seemed to come from the surface of the soil, and which rose like a fountain to the ceiling and inundated all the room. This fact, which was observed by several witnesses, may be considered as absolutely beyond doubt. It seems to us to be explained by a mechanical effect of electricity quite analogous to that which takes place in our experiment.

What may be the cause of these effects of aspiration produced by electricity when it is derived from a source combining quantity and tension? We may suppose that under these conditions there are produced phenomena of reaction and of deportation, comparable to those produced with currents of gases or vapours under high pressures. When each individual spark, endowed with a great mechanical power bursts in the capillary tube, at the same time that there is compression in one direction there is rarefaction in its neighbourhood, and the motility of the medium in which the phenomenon is produced causes the liquid to rush into the vacuum formed, and may thus effect a well-marked ascending movement.

As for the peculiar features of the current of electricity, approximating at once to those of voltaic and of statical electricity, which produces these phenomena, they may be ascribed to the origin of this current, and especially to the medium which separates the electrodes or armatures. Here this medium is not, as in the battery, a liquid electrolyte, but a decidedly elastic and insulating matter, such as mica. Nevertheless it is traversed or thrown into vibration by the action of a current of high tension; for there is produced a charge-spark with these condensers, as if the armatures had between them a slightly conducting connection. When the condensers are discharged the plate of mica is likewise traversed like the electrolyte of a battery, and to the sudden recomposition which is then produced in this elastic plate there corresponds, in the circuit outside the condensers, a mechanical effect equally abrupt and instantaneous. Hence if this effect is repeated consecutively a great many times we have a current *sui generis*, which may produce peculiar phenomena such as those just described.—*Comptes Rendus*.

DETERMINATION AND REGISTRATION OF THE CHARGE OF ACCUMULATORS.

WE are under the impression that Mr. Sellon, whose name is so well known in connection with secondary battery investigation, has for some time past been able to tell precisely what electrical energy is stored up in his batteries, or how much is left in reserve after the supply has been drawn upon, by very much the same means as that recently described before the French Academy of Sciences by MM. Crova and Garbe. These gentlemen, in their memoir, say:—We have succeeded in determining it and registering it automatically, by taking our stand upon the following principles. Let us admit that the chemical reactions produced upon the two plates of the accumulator are confined during charging to transforming the layer of lead sulphate of the positive plate into lead peroxide, and that of the negative plate into metallic lead; the charge corresponding to the decomposition of 1 equivalent of lead sulphate on each plate will transform :—

1. At the positive pole $Pb\,O,\ So_3$ into $Pb\,O_2$, liberating 1 equivalent $So_3\,Ho$; 2. At the negative pole $Pb\,O,\ So_3$ into Pb, liberating 1 equivalent So_3, Ho.

The electro-chemical equivalent of lead being 1·0867 milligramme, and that of the acid 0·51445 milligramme, we see that each coulomb stored up will act for each plate upon 1·0867 milligramme of lead, setting 1·0289 milligramme of acid at liberty.

In reality, the chemical reactions produced in the accumulators are not quite so simple, and we have observed phenomena which require further study. Still, for the determination which we purpose making, this theory may serve as a guide.

We made use of Planté accumulators, as modified by Faure, of the so-called "40 ampère hour" type. The weight of the active matter is 3 kilogrammes; we filled them with 1 kilogramme of acidulated water, containing $\frac{1}{10}$ of its bulk of acid. The liquid contained, therefore, 184 grammes sulphuric acid, which, if it entered entirely into combination, would require 388 grammes of lead. Let us admit that the accumulator can receive 40 ampère hours, or 144,000 coulombs; this charge corresponds to the reduction of 155·8 grammes of lead upon one of the plates, and to the conversion into bioxide of an equal weight of lead derived from the sulphate of the other plate. The quantity of sulphuric acid set at liberty will then be 149·25 grammes, or 3·73 grammes per ampère hour. For a charge of 40 ampère hours, the loss of weight of the plates, and the increase of weight of the liquid, will be respectively about 150 grammes. This motive force, proportionate to the charge, is amply sufficient to indicate and even to register its variations.

We arrived at this end by the following means :—

1. Accumulator of 40 ampère hours. Initial strength of the charging current 5·6 ampères. Initial specific gravity of the acid 1·04, at 15° C. Quantity of sulphuric acid contained in the accumulator, 62 grammes. The charge was prolonged for twenty-four hours. The strength of the current diminished slowly at first; at the end of six hours it was 5 ampères. A very slight escape of gas occurs on the two plates; the specific gravity is 1·10, corresponding to 108 grammes of acid. After charging for twenty-four hours the density had become 1·145, showing 200 grammes of acid in the liquid. The variation in the weight of the liquid has therefore been 138 grammes; that is to say, fairly close upon the calculated weight.

By noting from hour to hour the specific gravity of the acid, and the current strength in ampères, we may draw up a table which, for a given accumulator, will enable us to deduce the charge from the specific gravity. In a series of any number of identical accumulators, a determination of this kind, once made, will enable us to calculate the total charge of the system.

It is convenient, for approximate determinations, to make use of Rousseau's densimeter; 1 cubic centimetre of liquid taken from the accumulator enables us to find the actual charge of the accumulator by means of the curve of the quantities of sulphuric acid contained in aqueous solutions of known specific gravities.

2. We may construct an indicator of the charge based upon the variations in the density of the liquid. To this end, we fix to an orifice pierced in the bottom of the accumulator a gauge-tube, terminating in its upper part in a very wide reservoir, filled with a liquid which is not miscible with the dilute acid, but which has nearly the same density. The surface of separation of the two liquids in the tube serves as an index. In our experiments we made use of an acid, the initial specific gravity of which was 1·06, and of benzoic ether, the specific gravity of which at 15° C is 1·05. This constituted a kind of Kretz's manometer, highly sensitive. We have thus been able to follow the variation of the charge of an accumulator, either on charging it directly, or on discharging a charged accumulator into another previously discharged; or to study the influence of various circumstances upon the charge.

3. We adapted to the orifice above-mentioned a tube which brings the liquid into communication with a manometric capsule, closed by a membrane of caoutchouc, which, under the influence of the pressure of the liquid, varying with its density, moves a very light elbowed lever. We may thus indicate the charge of the accumulator by means of a needle moving on a graduated scale.

4. It is preferable to utilise the variation of weight of the lead plates to set the indicator in action. We suspend the accumulator immersed freely into the acid liquid to one of the arms of a balance, fitted in the prolongation of the indicating needle with a rod hung with a counterpoise, which converts it into a sort of steel yard. The accumulator being counterpoised by a movable weight at the other arm of the lever, the needle indicates the variations of the charge. This arrangement is identical with that which has been applied by one of us to the registration of the barometer; it is very convenient and very accurate. In our apparatus the needle is of light wood, and is one metre in length; it is easily made to traverse more than 0·20 metre for a complete charge. We adapt to the end of the needle an ink pointer, which moves between a horizontal steel rule, and a band of paper which unrolls perpendicularly. An electric clock transmits every ten minutes a current which acts upon an electro-magnet, and applies the needle against the paper when this has advanced one millimetre.

We have thus obtained curves of a remarkable regularity, both for the charge and the discharge, and their distinctness renders it possible to study the most delicate features of the charge of the accumulators.

ELECTRICAL STUDIES AT CORNELL UNIVERSITY.

THE course in electrical engineering in Cornell University has now been established for two years, and is already well patronised. It requires four years of study for its completion, the object, writes Prof. W. A. Anthony in the *Electrical World*, being to turn out, not electricians or electrical engineers merely, but educated men. To enter it students must have a knowledge of the common English branches and a part of algebra and geometry. In the university they pursue the mathematics through calculus, study the French or the German language, give some time to the study of English, devote several terms to the theory and practice of machine drawing, pursue for final terms the study of mechanics as applied to engineering, besides the work in general physics and electricity, which occupies a considerable portion of the time for three years.

As to equipment, the physical department of the university, where the study of electricity is pursued, is supplied with very complete arrangements for the experimental study of electrical science and its applications. The best instruments for electrical measurements are at hand, and students have practice in measuring resistances of conductors, of batteries and of instruments. They learn to test the accuracy of the instruments they employ. They measure electromotive forces by the quadrant and absolute electrometer as well as by various other means. There are four dynamo machines under charge of the department, besides several lecture room models and electromotors. Students make complete measurements and tests of these, and make constant use of them for various experiments. For instance, one student has been experimenting since last winter upon the effect of the various kinds of covering upon the rise of temperature of wires heated by electric currents; another has been comparing the different photometric methods as applied to the measurement of the illuminating power of arc lamps; another has been comparing the deposits of copper in voltameters having different sizes of plates, in neutral and acid solutions, in solutions of different degrees of concentration. Currents of various strengths from 1 to 10 ampères were employed. Silver voltameters were also compared with copper.

There is just now being completed a "magnetic observatory" for furnishing facilities for magnetic experiments and electrical experiments that depend upon the uniformity of the magnetic field around the instrument.

Iron has been rigidly excluded from the construction of the building. Here will be mounted the instruments for determining the elements of the earth's magnetic field, but the principal instrument is an enormous tangent galvanometer on the Helmholtz plan, capable of measuring currents from $\frac{1}{100}$ ampère to 200 ampères. The conductors for heavy currents are three-quarter inch copper rods. The deflections of the needle are read on a graduated circle fifty inches in diameter, and a suspended coil one metre in diameter, of 100 turns of wire, furnishes the means of determining the horizontal intensity of the earth's field at the exact place of the instrument at any moment, by observations requiring but a few minutes.

This observatory is placed so far from any of the other buildings as to be free from any magnetic disturbance from moving masses of iron. It is connected with the laboratory by several wires, among which is a pair of 0000 copper, for conveying the heavy currents. In connection with this equipment, and as accessory to the large tangent galvanometer, is a set of German silver resistances consisting of 36,000 feet of No. 16 wire in 60 sections of 600 feet each, connected to switches that permit of combinations in series, or multiple arc, or "multiple series," in all desirable ways. They give a variety of resistances from three-fifths ohms to 1,800 ohms.

The large tangent galvanometer has been constructed at the university, and it is proposed to construct next year a standard potential instrument to permit of the accurate measurement of all potentials.

All these instruments will be used by students as they have occasion. During this year several small dynamos and motors have been tested here, the students taking part in the work, and it is proposed in the future to continue this work of testing upon larger machines as opportunity offers.

ELECTRIC STEERING APPARATUS.

AN interesting exhibition of a newly-invented steering apparatus took place recently at the works of the Clayton Air Compressor Company, Brooklyn, N.Y.

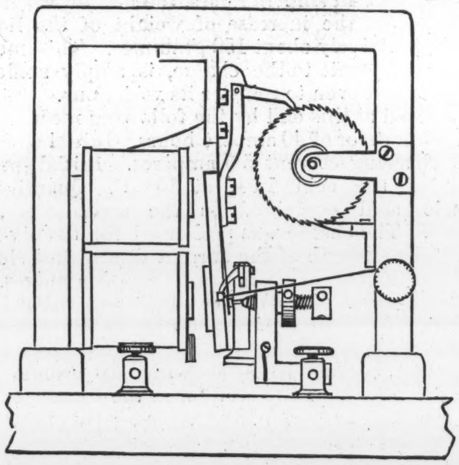
The apparatus, of which Mr. C. H. Washburn is the inventor, consists, as described by the *American Engineer*, of the application of compressed air, operated by means of electrical apparatus, to the movement of the rudder and steering of the vessel. The invention consists essentially in the combination of a compressed air supply and a piston moving in a cylinder and operating directly upon the tiller wheel chains. A rotary valve of special construction regulates the supply of air to the cylinder.

The rotary valve is arranged to be operated by an auxiliary cylinder and valve, regulated by electric magnets which are actuated by a current controlled by the movement of the needle of a mariner's compass. A delicately operating mechanism is attached to the compass and connects it with the magnets by wires. The instrument may be so set, that as the ship deviates to a greater or less extent from her proper course, the needle of the compass is brought into contact with the electric mechanism in such a way that a current is passed to a pair of magnets, and these operate a valve motion opening or closing the air supply to the rudder cylinder and the rudder is operated and the ship is brought around to its course.

Independent of this automatic electric compass connection are provided two other modes of using or regulating the steering gear, one on the bridge, consisting of a small lever, which being pushed one way or the other, opens electrical communication which, affecting the magnets, causes the rudder to move to port or starboard, as the case may be. A second is by means of a wheel in the wheel-house which operates the electrical apparatus and thence the rudder. For the work to be done, the apparatus takes up very little space and is simple in construction and to all appearances quite durable. The apparatus is to be placed on board the U. S. steamer *Dispatch* for a thorough trial. No doubt was expressed by any of the visitors at the temporary trial, as to the success of the apparatus and its general adoption in marine practice.

RUDOLPH'S ELECTRO MOTOR.

IN the REVIEW for May 9th, we illustrated a very ingenious electro-motor, invented by Mr. Bayley, the motion being produced by a vibrating armature or trembling bell action. Mr. Rudolph has brought before our notice a motor devised by him towards the end of the year 1882, and as this has some points in common with the more recent apparatus of Mr. Bayley, we append an illustration thereof. Mr. Rudolph has not patented his motor, nor does he think, and in this we agree with him, that the instrument has, in its present form, any real commercial value; still, he is inclined to the belief that this kind of motor has a future before it and that with further investigation it may become of value.



In the armature the inventor thinks he has made a slight improvement by adding a circular piece of iron at the lower end, somewhat larger in diameter than the core of the lower coil; furthermore, a spring across the armature enables the operator to effect an adjustment for different battery powers. We need not enter into unnecessary particulars as the sketch is so evidently self-explanatory.

Long-Distance Telephoning in the West Indies.—The *Colonies and India* states that by a simple connection of the telegraph wire to the telephone instrument in the News Room at Port of Spain, it was found that communication with San Fernando, a distance of 45 miles by wire, could be carried on with as much ease and precision as between any two places in the city.

MEASURING APPARATUS.

WE think it is useful now to raise a cry of alarm on the subject of the measuring apparatus profusely used in the industries. It is absolutely impossible to place the least confidence in their indications, if we do not take care to carefully and periodically verify their calibration. In order to show that the errors committed by the employment of these apparatus are not within the ordinary limits of toleration generally accepted in the industries—1 or 2 per cent.—but far exceed all that we would expect, we will briefly make known, writes M. Hospitalier, in *L'Electricien*, the comparative results of experiments made at the laboratory of the Ecole de Physique et de Chimie Industrielles, in the presence of a certain number of witnesses who were no less astonished at the results than ourselves.

The comparisons were made with six ampèremeters from different French, English, and German houses. Of these six ampèremeters some have been at the Ecole about two years, others scarcely a month. All retain the graduations made by the manufacturers. None of them have ever been submitted to the action of currents which exceed the limits of their graduation.

These six ampèremeters connected in series, were put in circuit with a battery of accumulators giving an absolutely constant current in each experiment. The actual current strengths were checked by an indirect method described in detail in *L'Electricien* of June 1st, 1884 (No. 76, page 486), which gives results accurate within about 1 per cent.

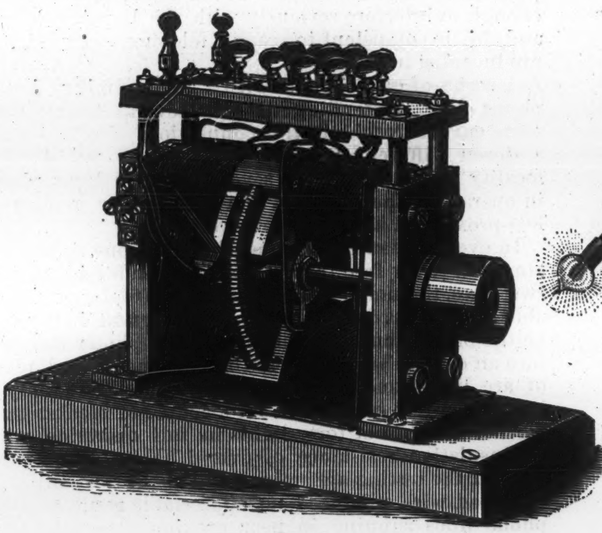


FIG. 1.

The six ampèremeters, being traversed by the same current, should have given practically the same indications.

In one of the experiments, the difference of reading between the two furnishing the greatest diversity was 39 per cent. on the lowest indication and 25 per cent. on the highest.

By increasing the strength of the current, the relative error diminished, but never fell below 20 per cent.

It follows from this fact, that six different establishments, all in good faith, each possessing one of these six instruments, and measuring, for instance, the consumption of incandescence lamps under *identical* conditions, would nevertheless find figures of which the difference would vary from 20 to 30 per cent. on an average.

What are the causes of these lamentable discrepancies and what is their remedy?

The causes of discrepancy in calibrated measuring apparatus are numerous; some are chargeable to the manufacturer, others are independent of him, and it is for this reason that we do not wish to describe more explicitly the apparatus which have given the greatest divergence.

The most important of these causes of error are an imperfect graduation, obtained by the interpolation of a number of insufficient points from the middle of the graduation, especially when the deviations are not proportionate to the current strength. We intend to study this question again in detail, and to analyse experimentally all these causes of error, but we think it desirable not to wait longer before raising a cry of alarm, which we may sum up thus: "Beware of calibrated measuring apparatus."

AN EXPERIMENTAL DYNAMO AND POCKET BATTERY.

THE Excelsior Manufacturing Company of New York has constructed the little dynamo which we illustrate (fig. 1), to meet the wants of experimenters in various directions, to whom a convenient source of electricity is a great desideratum. According to the description of the New York *Electrical World*, this handy little apparatus weighs but thirty-five pounds, and occupies a space of only about one-half a cubic foot. In order to serve the different requirements under which such a dynamo would be used, it is arranged so that it can be employed either as a series or a shunt-wound machine. This change is effected by means of the plugs shown on the board above the machine. The construction is substantial, and the machine is capable of delivering 450 watts under the varying conditions in which it can be worked. A special machine of similar construction is designed for electro-plating.

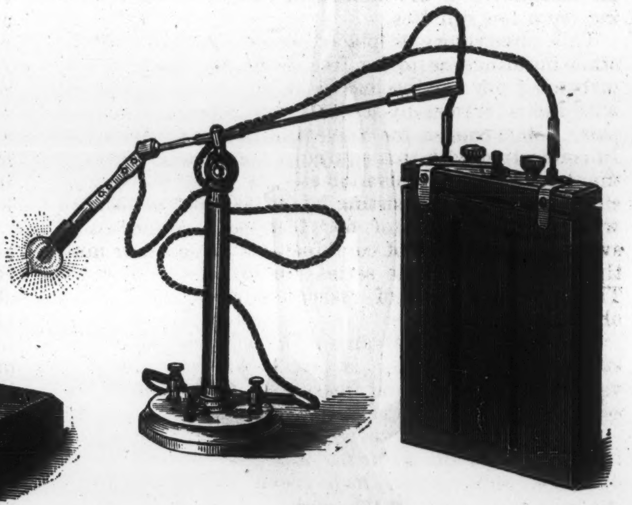


FIG. 2.

In addition to this dynamo, the company makes a novel pocket battery shown in fig. 2. The ebonite case is divided into three circular compartments, each of which is lined with silver foil. To the cover three rods of zinc are attached, which dip into a solution of bisulphate of mercury contained in the cells. This compact little battery gives an electromotive force of more than 4 volts and keeps a miniature incandescent lamp aglow for a considerable length of time. Our illustration shows it put in connection with a lamp mounted upon a stand for the use of microscopists, its steady light making it especially valuable for this purpose. It can also be used for purposes of amusement, a special pin and connections being provided for that purpose. For surgeons' and dentists' use, as well as for amateurs, the arrangement shown in Fig. 3 was devised, with the intention of obviating the necessity of using batteries as a source of current. The box on the table contains a small dynamo, which is worked by a treadle and generates current for a six candle-power lamp. This can be applied to illuminating the internal cavities of the body, and the machine requires no care whatever for its maintenance, being always ready for work.

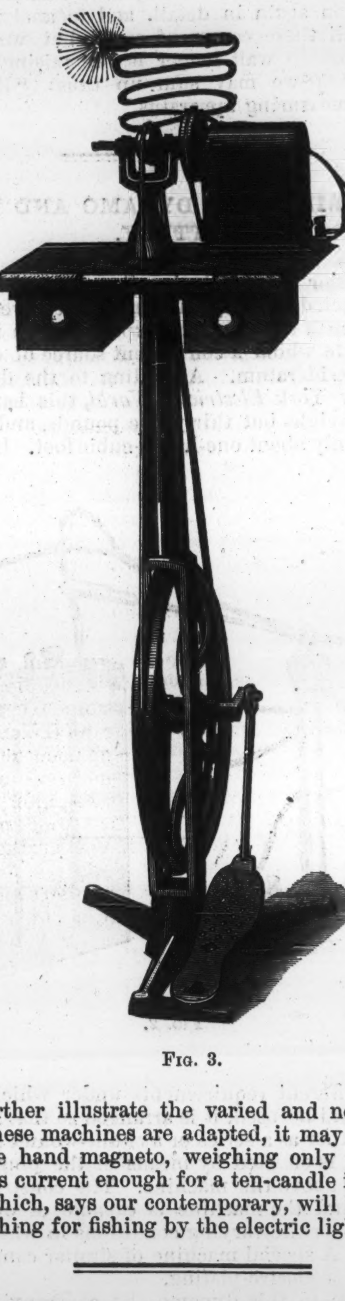


FIG. 3.

To further illustrate the varied and novel uses to which these machines are adapted, it may be said that the little hand magneto, weighing only ten pounds, furnishes current enough for a ten-candle incandescent lamp, which, says our contemporary, will be found the correct thing for fishing by the electric light.

UNDERGROUND ELECTRIC LIGHT AND TELEPHONE WIRES.

IN the course of the proceedings of the Electric Light Convention held in Chicago recently, the mooted question of how near and yet how far apart telephone and electric light and other wires might neighbour, and remain on good terms, was discussed quite earnestly, says the New York *Electrical Review*. To cut off a wrangle which was like to become interminable, without reasonable result, the matter was given to a committee who, granting the premises of the telephone folks, issued some very motherly consolation to these electrical little people, and showed them how to avoid getting stepped on, by keeping out of the way of the procession.

But the fact is there is much less of this sort of interference in well-regulated circuits than has been generally supposed, yet while it is true that more or less induction may be felt from a dynamo current under certain circumstances, recent experiments seem to point to the fact that very much of this effect may be avoided by proper insulation; in other words, that it is not induction proper, but in reality a minute quantity of a powerful current through a derived circuit to the extremely sensitive telephone.

Willoughby Smith's experiments illustrating his paper on induction and conduction showed that a current passing through a fluid conductor did not follow the direct line of least resistance, but split up in curves like lines of forced curves which diverged at their entrance and converged to the opposite terminal of the fluid. From these premises he submits that currents from ground connections may wander through the ground in any, or perhaps every direction.

Now it is unfortunately too true that a large proportion of all electric light circuits are the unknown possessors of slight grounds, and the usual test of hand generators is incompetent to indicate these, inasmuch as a hand generator will only show an insulation resistance of 10,000 to 15,000 ohms, and in practice, where the magnets refuse to ring, the line is assumed to be clear.

If then a lighting circuit has two slight grounds, part of the current becomes a wanderer, probably not enough to interfere seriously with the burning lamps, and this is competent to reach a telephone ground and produce disturbance.

A series of experiments with a large number of telephone lines, extending through several hours, gave some curious results in this connection. No less than a dozen different telephone lines were tested in a locality where there were several electric light plants in operation, the wires of the two having greater or less proximity, and all being overhead.

In every instance, save one, the telephone lines were almost entirely free from annoying sounds—in all, save two cases, the noise was too indistinct to be recognisable as that produced by dynamo current induction. In the one instance mentioned the telephone line ran into an establishment where there is an isolated plant of arc lights, and the wires ran parallel, and only a half-dozen feet or so apart, for a couple of blocks.

Another plant of forty lights in full operation, with an insulation resistance of over 1,100,000 ohms—the limit of the testing apparatus—and about three miles of overhead wire, produced no appreciable result on telephone lines running in near proximity to its wires, either parallel to or crossing these.

These are the facts in the case. If there is any better explanation than that hinted at above—namely, diffusion of current through slight grounds, let us have it.

SOME FORMS OF ELECTRIC BELLS.

THE following is an extract from Mr. Giltay's article on Electric Bells in *De Natuur* for October, 1883, referred to in his letter :—

Dr. Schellen has invented an electric bell in which the current is not interrupted by the attraction of the armature. His arrangement renders it possible to join up several bells in series in one circuit. He has attained his object in an extremely simple manner, and it will be seen from the following description of the apparatus that Schellen's bells are not at all more complicated than those at present in use.

Fig. 1 is a diagram representing Schellen's bell. *a* is the electro-magnet, *b* the armature, *c* the hammer which strikes upon the bell. The armature is provided at that part of its surface which faces the armature with a small steel contact spring, *d*, tipped with platinum, *e* is a small pillar fitted with an adjustable contact screw with platinum point, and 1 and 2 are terminals to which the conducting wires are screwed.

Terminal 1 is connected to the pillar and contact screw, *e*. Terminal 2 is connected to the metal piece, *f*, to which is attached the spring, *g*, which carries the armature, *b*. This terminal is further connected to one of the ends of the coils of the electro-magnet. The other end of those coils is connected to the small pillar, *e*. Supposing now a current to enter, say at terminal 2, it will then pass through the coils of the electro-magnet and reach terminal 1 by the pillar, e^1; the armature will now be attracted, and the spring, *d*, will come into contact with the contact screw, *e*. As soon as this happens, the greater part of the current will be shunted, passing through *f*, *g*, *b*, *d*, instead of through the coils of the electro-magnet, which will now lose nearly all its magnetism and release the armature; the contact at *d* will therefore be broken, and the whole current will again flow through the coils of the electro-magnet; the armature is again attracted, and so on.

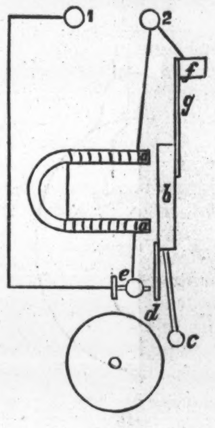


FIG. 1.

It will be seen that in this arrangement the current is never interrupted, it is only shunted.

Although this bell was invented years ago, it appears to be very little known. It has indeed been recently re-invented by the Belgian electrician, Lippens, who imagined precisely the same arrangement, but had a different object in view.

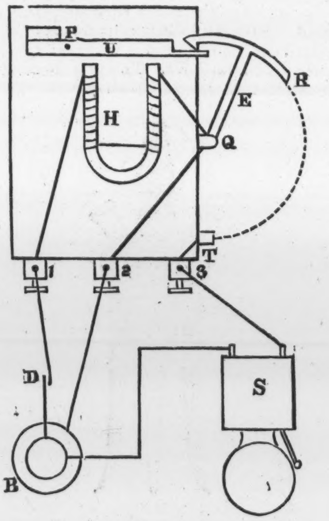


FIG. 2.

The reader will have observed that the construction of Schellen's bell is not less simple than that of the ordinary electric bell; the contact screw is on the other side of the armature, but otherwise the arrangement is about the same. The advantages of Schellen's bells are that they can be joined up in series in the same circuit, and that as there is no interruption of the current the platinum contacts are not damaged by the spark due to the extra current set up by the breaking of the circuit.

We will now consider a second condition which is frequently essential in the erection of electric bells, namely, a bell that will continue to ring until the person whose attention is to be attracted causes it to cease ringing by pulling a cord. Bells of that description are often used for the purpose of awaking domestic servants, or for night bells for doctors and chemists. In order to arrange a continuously ringing bell a so-called relay is generally used.

Fig. 2 shows the manner in which such an apparatus is arranged. H is an electro-magnet above which is the armature, U, which is pivoted at P; E is a switch pivoted at Q, which catches in a notch at the extremity of the armature, B is the battery, D the push, and S an ordinary electric bell.

Suppose now the push, D, to be momentarily depressed, and let us consider what will happen in that case. The current from the battery, B, flows by D to terminal 1, and thence to the coils of the electro-magnet; after having passed through the coils it returns by Q and terminal 2 to the zinc pole of the battery. As soon as the current magnetises the electro-magnet, H, the armature, U, is attracted, and the switch, E, is released, and falls back on the contact piece, T; and now the bell begins to ring, for the current now flows from the carbon pole to one of the terminals of the bell, from the second terminal of the bell by 3 and switch E to Q, and thence by 2 to the zinc pole.

It is clear that the bell will continue ringing until the contact between E and T is broken. We have considerably simplified this arrangement. The relay, as we have seen, consists of an electro-magnet, an armature, and a switch. As each electric bell is already provided with an electro-magnet and an armature, it will be possible to convert any ordinary electric bell into a continuously ringing bell, simply by fitting it with a switch.

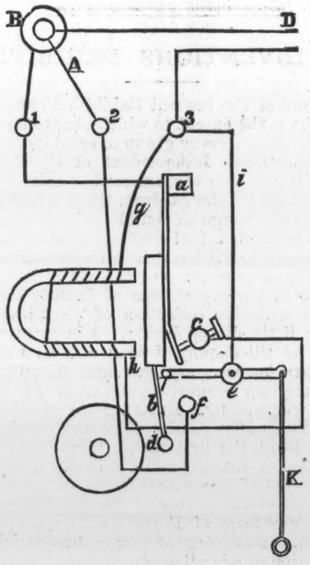


FIG. 3.

Fig. 3 represents a continuously ringing bell as constructed by us.

It will be seen that the construction of this bell does not differ in principle from that of the ordinary bell. The electro-magnet, the armature, and the contact screw, C, are all of the usual construction. The bar which carries the hammer, *d*, is provided with a small ridge or projection, *b*, on which rests a metal pin which is screwed in the end of the pivoted lever, *e*, *and insulated from that lever by ebonite*. To the other end of the lever, *e*, is fastened a cord which carries a ring; *f*, is a metal pillar, on which the lever falls as soon as it can leave the projection, *b*.

The connections of the different parts of the bell are as follows :—

1, 2 and 3 are terminals.

Terminal 1 is in permanent connection with the spring which carries the armature.

Terminal 2 is connected to the pillar, *f*.

Terminal 3 is connected to one of the ends of the coils of the electro-magnet and also to the lever, *e*. The other end of the coils of the electro-magnet is connected to the contact screw, *c*.

The external connections are as follows :—

One of the poles of the battery, the zinc pole, for instance, is connected to terminal 1. The carbon pole is connected to terminal 2 and also to one of the springs of the push. The other spring of the push is connected to terminal 3.

As soon as the push is closed the current will flow, as follows :—

Carbon pole, upper spring of push, lower spring of push, terminal 3 ; wire, *g* ; coils of electro-magnet; wire, *h* ; contact screw, *c* ; spring of armature, *a* ; terminal 1 ; zinc pole.

As soon as the armature is attracted the lever, *e*, falls from *b* on *f*. If the push is now no longer depressed the current will not be interrupted, but flow as follows :—

Carbon pole ; wire, A ; terminal 2 ; pillar, *f* ; lever, *e* ; wire, *i* ; terminal 3 ; wire, *g* ; coils of the electro-magnet ; wire, *h* ; contact screw, *c* ; armature spring, *a* ; terminal 1 ; zinc pole.

It is evident that the bell will now continue to ring until the contact between *e* and *f* is broken by the cord, *k*, being pulled. The arm, *e*, rests then again on *b*.

This bell answers the same purpose for which formerly two separate pieces of apparatus, a relay and a bell, were required. Its outward appearance is similar to that of an ordinary electric bell. If a switch is placed in wire A, and left open during the day, the apparatus can be used as an ordinary electric bell, which will ring as long as the push is depressed.

THE INVENTIONS EXHIBITION.

A STRIKING feature of the present Exhibition compared with any of its predecessors is the extent to which electricity is to be found revealing itself in almost every group of exhibits in various applications and connections. Independent of the electric lighting, which this year is not only throughout the interior but has been extended to the whole of the gardens, there is hardly a court or a gallery in the entire range of buildings but contains exhibits, either having a direct electrical connection, or being in some indirect way of more or less interest to all who make this branch of science their study or pursuit. On the other hand, if the east arcade be visited in the expectation of finding there a concentrated and representative collection of electrical exhibits the result may be a little disappointing. A large proportion of the space is allotted to the display of what may be described as shop window goods—bell pushes, gongs, gas lighters and the like. There are, however, some very interesting and creditable displays, as we hope to show as we go along. Entering the arcade by turning to the right immediately after passing through the principal entrance from Exhibition Road, the first stand (1291) is that of Messrs. R. E. Crompton & Co., of London and Chelmsford, whose exhibit we shall deal with in detail in our next issue.

The next exhibit (1292) is that of Messrs. Paterson & Cooper consisting of the new form of Phœnix dynamo, arc lamps, measuring instruments and fittings of various kinds ; following which is (1293) a collection of miscellaneous articles, the manufacture of the Varley Electric Patents Proprietory, including their flexible carbon lamp and illustrations of the mode of preparing the carbons for it.

Messrs. Woodhouse and Rawson (1293) have a most comprehensive collection of appliances in connection with all the principal applications of electricity. The improvement in efficiency attained in the Woodhouse and Rawson lamps is thus stated by the makers :—"Until recently the efficiency of the two best known lamps has been 3 to 3½ watts per candle-power, and 4 to 4½ watts respectively, whereas, Messrs. Woodhouse and Rawson's new filament lamps require the expenditure of under 2½ watts in low resistance lamps, and under 3 watts in high resistance lamps. The effect of this is that by reducing the amount of electrical energy required, not only is the first cost of engines, dynamos and cables lessened by about 25 per cent., but there is also a proportionate reduction in the maintainence expenses, such as coal, oil, waste, &c. Amongst numerous proofs of this, the average efficiency of the Woodhouse and Rawson lamps, tested by the jurors of the Vienna Electrical Exhibition, was 2·38 watts per candle-power—a very high result ; and when a 20 candle-power lamp was subjected to the unfavourable condition of being under-run and worked at 10 to 11 candle-power only, its efficiency was as high as that of the 'Swan' lamp, and, when at 8 candle-power only, as high as that of the 'Edison' lamp." A group of lamps of 10 C.P. with 100 volts E.M.F., here shown are the first of this highly efficient and useful type that have ever been made. Their utility will be understood when it is pointed out that 100 volt lamps of 20 and 10 C.P. can now be connected in simple parallel. Messrs. Woodhouse and Rawson, in addition to having two patents of their own, have acquired the combined patents of Messrs. Lorrain & Waters, and others, covering the entire ground of the silvering of incandescent lamps. The method of application is exceedingly simple, and consists in forming a section of the globe into a concave mirror by depositing a thin coating of silver by chemical means on the outside of the lamp. The silver may be applied so as to throw the light either forward or downward, according to the position in which it is proposed to place the lamp, and in addition to an increase of illuminating power, a more pleasing effect is obtained by the expansion of the threads of light into a solid flat flame appearance, which has not hitherto been obtained. Up to the present time silvering the backs of incandescent lamps has not answered, owing to the heat causing the silver to peel off. This has now been got over ; the reflecting surface, moreover, cannot become tarnished—it is as durable as the lamp itself. Examples of different types of dynamos are also shown. One of these illustrates the application of transmission of power ; a water-wheel at some distance from the stand drives a dynamo, supplying current to a motor within the stand, which is connected by belting in the usual manner to a dynamo, which in its turn supplies current to lamps fitted up around. Samples of different forms of accumulators are shown, including small ones for use with safety lamps for miners and gasmen, surgical lamps, &c. The principal advantages of the holders for incandescent lamps, as shown in the cut, over those with rigid hooks are the reciprocal action of the spiral springs, and the prongs ensure safe and permanent connection with the platinum loops of the lamps, without danger of the latter being in any way strained or disturbed. The three prongs hold the lamp very firmly in position, so that contact is not liable to be broken or impaired by the vibration to which lamps in certain situations (such as on shipboard, trains, &c.) are subject. These holders being carefully made are very serviceable ; the three prongs and the ring are cut out of solid brass tubing by a special tool, and in this way there is no chance of the parts coming to pieces. The

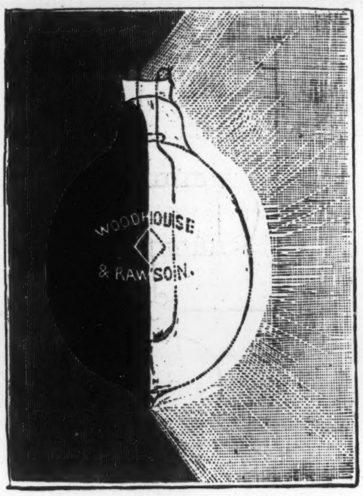


FIG. 1.

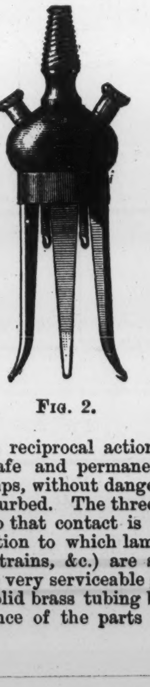


FIG. 2.

spirals are drawn very hard, and are specially treated to prevent oxidation. The holders, whilst generally supplied with a male screw to fit the usual bracket hole from ¼ in. to ⅜ in. in diameter, can be made with a female thread, or in any other way desired. The switch in combination with the holders is for some purposes a convenient and economical arrangement. An apparatus has been designed for use in places such as railway signals, ship signal lights and railway carriages, where it is of great importance that there should be no cessation of light from breakage of the filament of the lamp. By means of this appliance, when the filament of a lamp breaks, another lamp is lit up. There are also a number of samples of switches and safety junctions for electric lighting, some presenting special points of interest. Mr. Cunyngham, the author of the well-known book on "Electric Lighting," and Messrs. Woodhouse and Rawson, have lately brought out an automatic cut-out which is used by them in all cases where it is required to sever or make an electric connection on the current, or E.M.F. exceeding or falling below a given strength. Its action depends upon the raising of an armature against the action of gravity when the current passing round a small coil exceeds what the instrument was adjusted for. This will be found fully described in the ELECTRICAL REVIEW for January 24th. All the requisites for telephone work will be found here, including switches, indicators, and other specialities. Jensen's electric bells are put forward as being the most deserving of notice in this class of work, and as possessing several advantages over the ordinary form. A bell having the form of an ordinary church bell is used, and inside is placed a single electro-magnet of special construction, in which the armature, besides being magnetised by induction, is directly polarised by being in actual magnetic contact with the iron core of the magnet. These bells produce a musical tone instead of the harsh sound heard upon the ordinary gongs. They can be attached to a wall or any projection in any position, the usual unsightly case containing the magnets being of course dispensed with. One useful modification of the bell has a responding attachment, so that the person ringing receives an intimation that the summons has been heard, and numerous and ingenious devices in the signalling way are being arranged. It is said that one of the usual complaints against electric bells is, that no means exist of knowing whether the bell has rung when the push button has been pressed. The Mackenzie indicator seems to remedy this defect, and to be very simple and of an efficient nature. Its mode of action was fully illustrated in the REVIEW for April 25th. Such an instrument might be applied to numerous other purposes, such, for instance, as (*a*) telephone circuits between exchange and subscribers; (*b*) between exchanges, thus showing every time the call bell is rung, that the bell is actually ringing, and that therefore the circuit is in proper order; (*c*) on railways, in signal boxes, this little indicator would be useful, as the pointsman would be certain that the signal transmitted by him to a distant signal box had been received. Among other apparatus may be mentioned terminals for electrical work, electric light mains and leads specially designed and made to suit the requirements of incandescent lighting and other forms of wire for telegraph, telephone, electric bell, and other purposes; carbon rods, solid and cored, plates, cut and compressed; complete set of electrical engineers' sundries, surgical lamp holders, and other electric apparatus used by the profession; two sizes of pocket induction coils complete, with batteries, &c.; and, finally, electrical jewellery, such as pins, brooches, coronets, &c., with small fairy accumulators for the pocket, &c.; set of jewellery for theatrical purposes.

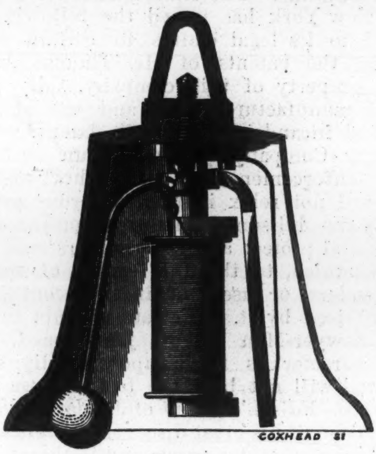


FIG. 3.

The Edison and Swan United Electric Light Company (1296) exhibit two Edison-Hopkinson dynamos, one of which is the identical machine which was put through the ordeal of a fortnight's continuous run at Manchester in January last, particulars of which were given in the ELECTRICAL REVIEW of January 24. The result went to prove, among other things, that the durability of the wearing parts of a dynamo of this type are much greater than was previously thought attainable. The rest of the exhibit consists of fixtures, sockets, switches and other arrangements connected with electric lighting.

TECHNOLOGICAL EXAMINATIONS.

TELEGRAPHY.

THE following is the examination paper to which one of our correspondents refers :—

INSTRUCTIONS.

The Candidate must confine himself to one grade only, the Ordinary or Honours, and must state at the top of his paper of answers which grade he has selected. He must *not* answer questions in more than one grade.

If he has already passed in this subject, in the first class of the Ordinary Grade, he must select his questions from those of the Honours Grade.

The number of the question must be placed before the answer in the worked paper.

Three hours allowed for this paper.

ORDINARY GRADE.

1. What tests are applied to iron telegraph wire in order to ascertain its quality?
2. What is meant by "weather contact" on a telegraph line, and how can it be prevented?
3. A submarine cable is to be laid in waters where it is liable to be attacked by the teredo worm. How can the action of the latter be guarded against?
4. State the practical value of the so-called absolute system of units as compared with an arbitrary system.
5. Describe the half deflection method of measuring the resistance of a battery by means of a tangent galvanometer, and state why it is necessary that the resistance of the latter be small if the resistance of the battery be small.
6. Compare the relative advantages and disadvantages of the "open" and "closed" circuit, Morse system of working.
7. Sketch and describe the Blake telephone transmitter.
8. Why is it that speed of working is less on a long submarine cable than it is on a land line? State what are the elements which cause the difference.
9. How would you compare the relative conductibilities of two wires of different metals, the lengths and diameters of the samples being different?
10. A telegraph instrument which requires a known amount of current to make it work properly is intended to be fitted on a line of known resistance; how would you calculate the battery power required, allowing for a possible loss of 50 per cent.?

HONOURS GRADE.

1. A telegraph line consisting of two wires insulated on cross arms has each wire worked with sensitive apparatus, and it is found that the signals sent on one line are partly reproduced on the other. How would you ascertain to what cause this is due?
2. If a shunt is placed across the terminals of the electromagnet of a Morse instrument the action of the armature becomes sluggish. Explain exactly why this is the case.
3. How is "Double Current" Morse working effected on a Universal Battery system?
4. Sketch and describe a switch which will enable the connections of a Duplex Single Current Morse instrument (without relays) to be changed, so that ordinary, or simplex, working can be resorted to if necessary.
5. What tests are applied to submarine cables during manufacture? Describe briefly how the tests are made.
6. Describe minutely the construction of the porous pot Leclanché battery, stating how the connection is made on to the negative element so as to prevent deterioration, and how the sealing of the porous pot is effected, &c.
7. A telephone apparatus worked on the twisted line wire system, the wires being on the same poles along with a number of telegraph wires, is found to suffer from inductive disturbance; to what cause may this be attributable?
8. How are the joints in the core of a submarine cable tested?
9. How can the individual conductor resistances of three telegraph wires, running on the same poles, be measured without using earth?
10. Sketch and describe a terminal telegraph pole, showing how the "leading in" wires are brought into the office from it.

ELECTRIC LIGHTING IN MERCANTILE OFFICES.

ONE of the most complete installations of electric lighting in the metropolis which has yet come under our notice has just been carried out by Messrs. Woodhouse and Rawson for the firm of Frederick Huth and Co., of 12, Tokenhouse Yard, E.C.

The fitting up of these extensive offices necessitated the display of a considerable amount of ingenuity, for in no case are any of the conductors visible, and to effect their concealment it was imperative to adopt measures which but rarely tax the cunning of the contractors to such an extent as is here shown; the greatest credit is, therefore, due to Mr. Harris, the representative of Messrs. Woodhouse and Rawson, for the ability with which he overcame the many serious obstacles which arose as the work progressed. The plant consists of an 8 H.P. vertical engine and boiler, by Marshall, 28 cells of the Elwell-Parker secondary batteries, 1,000 ampère-hour type; a shunt wound dynamo also by Elwell and Parker; 200 incandescent lamps of varying candle power of the contractors' well-known manufacture, and a Woodhouse and Rawson patent switch board, together with the innumerable and smaller accessories of electric lighting installations.

We were much impressed with the excellent illumination of a very large room accommodating some scores of clerks engaged in correspondence only. Advantage has been taken of the decoration of the ceiling to attach 50 candle-power lamps to various ornamental bosses, and when these glow lights are simultaneously switched on the room is flooded with a mellow and admirably diffused light. In addition to this arrangement lamps of a smaller candle-power are fitted to each desk.

Another establishment some doors off is supplied with current from the same source sufficient for about 30 lamps, the conductors being carried overhead from one building to the other. It is needless for us to recapitulate what advantages electric lighting possesses over gas for such purposes as here mentioned, but we do say that many other firms would certainly be induced to venture upon a similar installation by a personal inspection of the offices of Messrs. Huth and Co. These gentlemen must, we think, be well satisfied with the result of their enterprise, and their numerous employés will, we are convinced, appreciate the health-preserving properties of the electric light.

The space at the command of the contractors for engine, boiler, dynamo and accumulators, was not by any means too ample, but everything has been arranged in the most compact manner, and the whole installation from basement to roof is a fine example of well planned and intelligently executed workmanship. The only misgiving we have as to the satisfactory working of the system in the future is with respect to the secondary batteries, for the Elwell-Parker invention has scarcely been before the public for a sufficient length of time to convince us that its longevity can be calculated with any degree of certainty. Be this as it may, we are pleased to see that secondary batteries form part of the plant.

NOTES.

The Illumination of Ornamental Grounds.—It is generally believed that for effect nothing has yet been produced which can in any way compare with the illumination of the gardens at the Inventions Exhibition. This idea, however, would have been somewhat shaken could the frequenters of South Kensington have been present at the evening *fête* at the Crystal Palace last Saturday. These beautiful and well-wooded grounds lend themselves to the purpose in a manner which is quite out of the question at the Inventions Exhibition, and the effect was one of supreme splendour, the Gülcher electric light adding not a little to the beauties of the scene. The *fête* is to be repeated, we understand, this evening, weather permitting; and to those who think Sir Francis Bolton's display a marvel of artistic illumination, we would say, compare it with that to be seen in the charming woods, brakes, and lakes of the Sydenham Palace.

Electric Lighting of Vinegar Works.—The works of Messrs. Champion, vinegar makers, of Old Street and City Road, E.C., which 1,500 persons are said to have visited within a fortnight, in order to view a new monster vat, have been fitted with the electric light, under the supervision of Mr. Ross.

Lighting of the "Colossus."—The *Colossus* is ordered to be out of the hands of the dockyard authorities by June 21st, when she is to be ready for commission. She is having new improved "Brush" lamps placed on board, and is waiting for her electric gear.

Electric Lighting at Berlin.—The Royal Library at Berlin is to be experimentally lighted by electricity, and kept open a couple of hours later nightly, to enable the public to form an opinion upon the innovation.

The Incandescence Lamp Patents in America.—According to the *Electrical Review* of New York, the chief difference between the Edison and the Sawyer-Man claims seems to be that the former mentions "high resistance" as an essential, and while it may be doubted if a patent on a degree can be obtained, there is no doubt that "high resistance" will rule the day in the electric light suits. Every claim, says our contemporary, will probably be "resisted," high, low, and every other way.

Edison's Claims.—The Edison Electric Light Company of New York has issued the following circular in regard to its legal claims to certain patents:—"1st. That the patents of Mr. Thomas A. Edison, now the property of this company, fully cover the exclusive manufacture, sale, and use of any and all practical incandescent electric lamps. 2nd. That the Edison Company, having begun suits at law for the enforcements of its rights under these patents, will not relax in their vigorous prosecution. 3rd. That the Edison Company is prepared to fully guarantee and protect all its customers, and to prosecute and punish, to the full extent of the law, all makers, sellers, or users of incandescent lamps not duly authorised by it. The late attempt to establish for the Sawyer-Man patent, just issued, a fundamental character is made upon wholly superficial ground, and will not bear the test of close analytical examination. Edison's patent of January, 1880, applied for at the time of his great discovery, covers broadly all the elements of that discovery, and is therefore fundamental and controlling. The Sawyer-Man patent, constructed in the light of the knowledge of 1885, but having for its foundation unsuccessful laboratory experiments, only covers certain details of manufacture of carbons, as, for instance, paper and the specific genus of material to which it belongs, and is therefore secondary and subordinate. The claim that the Sawyer-Man patent is fundamental, simply because the narrow and valueless claim to the use of paper has been illegally and without notice to Edison broadened to a claim for all fibrous material, carries its own condemnation. If anything more is necessary to demolish it it may be stated that Edison, Swan, and others, have already used material absolutely non-fibrous, in preference to a material the claim for which is now held to control the construction of a practical lamp. The public have nothing to fear from the use of the lamp as supplied by the original inventor and discoverer, while they render themselves liable for damages by the use of his fundamental patent for a 'filament of carbon' if unauthorised by the Edison Company."

Electric Lighting in Norway.—We understand that the town of Bergen, in Norway, is to be lighted by electricity. A company is being formed to start a central station, and already promises have been received to take 3,000 incandescent lights and 70 arc lamps. The price of gas is 6s. 6d. per 1,000, and the price of coal from 11s. to 12s. per ton delivered at the central station. The engineer, Mr. J. S. Hopstock, is now in London for the purpose of getting tenders from the leading English firms, and it is hoped that the installation will be at work before Christmas this year. The company expects to pay from 5 per cent. to 6 per cent. to the shareholders, and obtain the sole concession of the Town Council for a number of years.

New Properties of the Electric Light!—Our American namesake has the following:—From a note elsewhere it will be learned that electric light appliances improve the acoustic effect in the case of the New York Capitol. The many advantages of the new illuminant are gradually being discovered and appreciated.

Domestic Electric Lighting.—The electric light is used at the residence of Mr. Sydney Courtauld, of Bocking Place, the installation having been carried out by the Consolidated Electric Company, of 68A, Cow Cross Street, E.C. The experiment appears to be an entire success, the house being brilliantly and effectively lighted by 64 Swan incandescent lamps, which are entirely under control. Mr. Courtauld has had the light carried all over the house, and one of the features in the system adopted is the use of accumulators. The lamps vary from 10 to 50 candle-power each. The motive power is a three-and-a-half horse Otto gas engine, and the whole cost of the installation, including engine house, engine, dynamo, accumulators, wire, electroliers, brackets, lamps, and labour was, we believe, under £500.

An installation at Cobham Park, Surrey, carried out by Messrs. Verity and Sons, for Charles Combe, Esq., has now been running for some time. There are over 230 lights, and the whole has been a most pronounced success. The same firm is at present lighting up Errol Park, Scotland, for Ogilvie Dalgleisk, Esq., with 170 lights.

Explosion on the "Inflexible."—The Admiralty has already provided against a recurrence of such an accident as that which recently occurred on H.M.S. *Inflexible*, by deciding to adopt the electric light even in the coal bunkers. Some of the fittings now being supplied by Messrs. Goolden and Trotter are strong hand lamps, specially designed for use in the bunkers.

Electric Lighting in New Zealand.—The volunteers of Dunedin went into camp about two months ago, and amongst the arrangements conducive to their comfort and enjoyment was an installation of the electric light.

The Gas Institute and Electric Lighting.—The twenty-second annual meeting of the Gas Institute of Great Britain and Ireland, was opened on Tuesday, at Manchester. There was a large gathering of gas engineers and managers from all parts of the country. Mr. Thomas Newbigging (Manchester), one of the founders of the institute, presided. The president, in his address, said he thought the increasing success which had attended gas enterprise during recent years was mainly due to four causes—reduction of leakage or unaccounted for gas; the moderate price of the raw material; the usage of gas for purposes other than lighting, and the increased utilisation of residual product. He was not so sanguine as were some that the gas motor would soon or even eventually, displace the steam motor. He thought the competition by the electric light in England under existing circumstances was simply out of the question. Even in countries where gas was sold at 20s. per 1,000 cubic feet, electricity stood but little chance with gas as an illuminant. How, then, could it compete with gas at, say, from 2s. 6d. to 3s. per 1,000? Mr. Frederick Siemens read a paper on distributing light and heat and supplying heated air to ordinary gas-burners. Mr. Siemens was of opinion that the influence of electric lighting upon gas lighting had been very great. People had been accustomed at exhibitions and elsewhere to brilliant illumination from single sources of light, and they called upon gas engineers to produce similar effects. The requirements of practical illumination had increased by degrees to such an extent that it was impossible to foresee at present where and how this general tendency would end. The same thing held good in regard to heating.

The Electric Light in Clubs.—We understand that Messrs. Verity & Sons, of Covent Garden, have obtained the contract for the electric light installation at the Naval and Military Club, Piccadilly. The plant is to consist of two double cylinder engines and boilers, two Edison dynamos of the newest form, and a large set of fifty-five Elwell-Parker accumulators. The engine room will be specially constructed at the back of the club, and throughout the whole installation every attention will be paid, and no expense whatever spared, to make this one of the most successful installations possible. This club is deservedly very popular, and will, we learn, be the *first* in London to instal the electric light. We may remark that there were four other competitors, and the plant is to be completed by the end of August.

Temporary Lighting.—At a ball given after a wedding at St. Ronan's, Tulse Hill, S.W., on the 11th instant, the rooms and conservatories were lit throughout by incandescent lamps. The work was carried out by the Electrical Power Storage Company.

At a dinner party given at 69, Portland Place, on the 2nd instant, the rooms were lit by incandescent lamps. The work was carried out for Messrs. Hucks & Co. by the same company.

Electric Lighting in the Suez Canal.—The electric lighting experiments in the Suez Canal are said to have given satisfactory results.

The Bell Telephone in the States.—The *New York Sun*, of May 18th, contained the following communication from its Boston correspondent:—"A sub-committee of the Legislature has been examining the books of the American Bell Telephone Company, pending action upon several bills affecting the corporation. The report, which has just been made, contains information which will surprise telephone users. It will show that the cost to the Bell Company of the ordinary rubber hand telephone is $1.62, and of the transmitter, $1.80; total, $3.42. The average rental charged by the Bell Company of the sub-companies is $7 per year each for the hand telephones and the transmitters, or more than four times the original cost. The net earnings of the Bell Telephone Company for the year ending March 1st, 1885, were $1,710,892.69, and the company, according to the statement of its officers to the committee, could have paid a 17 per cent. dividend on its present stock. The company now owns 329,826 telephones, of which 32,442 are in Massachusetts. The company received for rentals during the year ending March 1st, $1,969,442.74. The company owns stock in local telephone companies, which is carried on its books at $22,016,573.36. It is impossible to get at the real value of these stocks. They are not carried on the books at actual cost. Stock received for the franchise is carried at par, while stock purchased above par is reduced to par. All other purchases of stocks are carried at cost. These stocks are not at present worth the sum at which they appear on the company's books. The company has received on these stocks in dividends $1,021,730.26. It is understood that a majority of the legislative committee will report adversely on the question of State supervision of telephone services and rates, and that the Bell Company will probably receive authority to increase its capital stock to the $30,000,000 as asked. The most expensive lobby that has operated upon the members of the Legislature for many years is working in the interests of the Bell Company, and it looks as though the majority report of the committee will be successfully engineered through both branches."

Long Distance Telephony.—A New York contemporary states that Mr. Gillett, known in connection with long-distance telephony in the States, is at present in England, and is about to undertake a series of experiments on the Commercial Cable some time during the summer.

Bell Telephones in America.—The output of telephones by the American Bell Company for the month from April 21st to May 20th, inclusive, was as follows: 1885, 2,442; 1884, 5,023; decrease, 2,581.

The Telephone in Minneapolis.—Things must nearly have reached a crisis in Minneapolis to compel the local *Tribune* to assert that "the Minneapolis telephone system consists of a few second-hand coffee mills and several streaks of rust."

Another American Telephone Patent.—News comes from Washington that an inventor named Freeman has perfected a telephone which he claims is the superior of the Bell instrument. A patent for his invention has been issued. His telephone is said to be the exact opposite of the principle of the Bell telephone. The Freeman is operated by pulsations caused by the opening and closing of the circuit. The Freeman telephone, the New York *World* says, promises to make a fierce opposition to the Bell, if the latter does not buy the new invention.

Amalgamation of Telephone Companies.—It is stated that, although not formally completed, an arrangement has been made between the directors of the National and the Dundee and District Telephone Companies, under which the former company will acquire all the interests of the latter, as at June 30th, for the sum of £8,500. The paid up capital of the local company is £5,337, there being 1,000 shares with £4 10s. and 372 with £2 5s. paid. The directors of the Dundee Company have stipulated that the rate per instrument in Dundee shall not exceed that now paid in Aberdeen—viz., £10—which has been agreed to by the National.

Telephonic charges.—The *Financial News* last week gave the following examples of the extraordinary differences which exist in the rates charged for telephonic service in various parts of the United Kingdom:—

	£	s.
Dundee	5	0
Carlisle	10	0
Belfast	15	0
Leeds	14	0
Dublin	12	0
Aberdeen...	10	0
Leicester	14	0
Bradford	15	0
Ditto, second year ...	10	0
Halifax	10	0
Sheffield	10	0
Wolverhampton... ...	12	0
Wolverhampton and Birmingham	18	0
Wolverhampton and Walsall	17	0
Newcastle-on-Tyne ...	12	0
Newcastle-on-Tyne and Gateshead	14	0
Nottingham	10	10
Birmingham	12	0
Hull	14	0
Edinburgh	15	15
Glasgow	12	0
Liverpool...	20	0
Manchester	20	0

A correspondent subsequently pointed out an inaccuracy in the above compilation, stating that the charge at Glasgow is £20.

Telegraphic Money Orders.—At a meeting held in Bradford last week, it was resolved to request the Chamber of Commerce to take into serious consideration the question of money-order telegrams at uniform shilling rates for any sum not exceeding £5, with the object of the Postmaster-General being approached thereon, and the experiment tried for a period of six months in connection with the sixpenny telegrams; and, if successful, that the scheme should be extended to all the countries of the postal union as well as the British colonies. It was stated that the system is already in operation on the contiment and in New Zealand.

The Russian Telegraph in Central Asia.—The *Times* correspondent at Calcutta states that the Russian telegraph line is now completed to Merv, and also to Mahna, 70 miles from Sarakhs.

Destruction of Telegraphs.—Included in the course of instruction at the Engineer's Camp, near St. Petersburg, is the work of construction and destruction of telegraphs and railways.

Telegraph Lines in Mexico.—There are 13,224 miles of telegraph lines in Mexico. Since September last 400 miles have been erected.

Close Race with Time.—The *Financial News* is responsible for the statement that the result of the Derby was known in New York ere the contestants had pulled up on Epsom Downs. The Commercial cable transmitted the news from London to the *Herald* office in New York in one second.

Rewarding Telegraph Messengers.—On Saturday last the telegraph messengers attached to the Birmingham post office were presented with prizes for smartness and good conduct in presence of the mayor of the town and other gentlemen. In addressing the boys the mayor stated that they were about to have sixpenny telegrams, which would put the telegraph service at the disposal of many who could not now avail themselves of it. The British public would expect their sixpenny telegrams to be delivered with the same care and promptness as were now shown in delivering the shilling ones, and he could not help thinking that the combination of discipline and encouragement of which the Birmingham postmaster's system was made up was the best that could be devised for the efficient management of so large a staff.

Telegraph Revenue.—The receipts on the telegraph service from April 1st to June 6th, 1885, amounted to £280,000, a precisely similar amount having also been received from April 1st to June 7th, 1884.

Sixpenny Telegrams.—In order to facilitate the transmission of the sixpenny telegrams by reducing the addresses, Dr. Cameron intends, in the Telegraph Acts Amendment Bill, to move a clause providing for the codification of addresses. The clause will be as follows:—"In every town of over 50,000 the Postmaster-General shall cause to be prepared a code indicating the name of each street, square, and other place within the town, postal delivery of each such town, and shall cause to be exhibited at every postal telegraph office, and to be offered for public sale at reasonable prices, tables showing the names of the said streets, squares, and other places in each respective town, and their codified equivalents in each particular case; and in addresses telegraphed according to the said code, each group of five or less letters or figures employed in the addresses shall be reckoned as one word."

In consequence of the political complications created by the adverse voting upon the Government Budget proposals, we hear that it is probable that the Telegraph Acts Amendment Bill will be abandoned.

A Port Hamilton-Nagasaki Cable.—The telegraph ship *Sherrard Osborne*, according to reports from Hong Kong, has gone to the north, with the object of laying a cable between Port Hamilton and Nagasaki.

Secondary Generators or Transformers.—According to the report made by Professor Galileo Ferraris upon the improved apparatus of Messrs. Gaulard and Gibbs, an effective or practical return of 94 per cent. may be obtained when worked under the most favourable circumstances. This result must be eminently satisfactory to the inventors who have laboured long and incessantly in the face of considerable discouragement.

The progress of the central station in New Bond Street, which is to supply more than 5,000 lamps, will be watched with much interest, and should the installation turn out as successful in operation as is anticipated, it will be hailed with great satisfaction, for a fresh impetus to electric lighting generally will thereby be established. It should also act as a great incentive to the manufacturers of secondary batteries to still further increase the efficiency, reliability, and longevity of these apparatus, for they have one advantage over secondary generators or transformers which cannot be over-estimated, viz., the capacity for storing electrical energy.

French Screws.—We have received a useful catalogue giving carefully drawn representations of a very large variety of screws, terminals, clamps, zincs, and other battery accessories, manufactured by Messrs. Rheins and Barrière, of Paris, a house which has been established nearly a century, and whose productions are in high repute. Recently, with the view of making these goods better known in Great Britain, the firm have appointed as their agents Messrs. H. Lazarus and Co., of 36, Basinghall Street, London.

The Electric Railway at Brighton.—At the last meeting of the Brighton Town Council, the following report was presented: "At a meeting of the Works Committee, on the 22nd of May, the Town Clerk submitted the proceedings of the 21st day of May, requesting this Committee to consider and report whether it is advisable Mr. Volk's electric railway should be permitted to remain on the beach, and if the Committee should deem it advisable to continue such railway, to further report, suggesting terms and conditions upon which the Council should continue the concession. A letter was submitted from Mr. P. Hamilton, stating that the Electric Railway has proved a great convenience to the Kemp Town residents in affording ready transit to the centre of the town, and protesting against its being removed, and other letters to the like effect were also submitted. The consideration of the matter was deferred, and at the next meeting, on May 29th, it was determined to specially summon the Committee on the 17th inst., to consider the subject, and at the same meeting the Committee read a letter from Mr. Councillor Carpenter, suggesting that the Committee should obtain the opinion of the Corporation Solicitors as to the legality or otherwise, of permitting the Electric Railway to be constructed on the beach, and whether or not any person or company is bound to obtain an Act of Parliament before laying down or running a railway or tramway in Brighton, and that they should report such opinion to the Council. Resolved—That Mr. Carpenter be informed the Committee do not deem it necessary or advisable to adopt his suggestion, and that he be reminded that the Committee, in pursuance of the instructions of the Town Council, are about to report on the subject of the continuance of the railway." Mr. Councillor Carpenter commented at considerable length on the letter which he had written to the Works Committee, but ultimately the report of the Committee was agreed to.

This successful little line appears to monopolise the time of the Brighton Town Council without any decision being forthcoming. So far, this is of course advantageous to Mr. Volk, as his cars will go merrily along, we presume, pending a decision one way or the other. So far as we can judge, the arguments in favour of its continuance altogether outweigh any assumed disadvantages appertaining thereto, these existing apparently only in the minds of prejudiced individuals who, it seems more than probable, are somewhat jealous of the pecuniary success which has fallen to the lot of the enterprising Brighton electrician. We shall look forward with considerable interest to the result of the meeting to be held on the 17th inst.

Electric Bells.—If we may judge from our correspondence columns of last week and this, a considerable amount of interest has centred itself round Mr. Jolin's arrangement for placing a number of trembling bells in series. The latest contribution to this subject is a paper from Mr. Giltay, of Delft, in which is described Dr. Schellen's method of effecting the same result.

Telegraph and Telephone Overhead Wires.—The Press Association learns that the Government does not intend to follow up the recent report of the Select Committee on overhead wires by any legislation, considering that the recommendations passed by the majority of the committee were impracticable, and would invade private rights to an extent for which the Government cannot make itself responsible.

Proposed Extension of the Portsmouth Post Office.—The Postmaster-General having at length given his consent to the long contemplated extension of the chief post office at Portsmouth, the work is to be commenced as soon as possible, the contract for carrying out the same having been secured by Messrs. Bull & Son, of Southampton. The office is to be more than doubled in size, and the chief telegraph department will then be removed from the Portsea office, where it has been centred for many years. At present, telegrams are only received at the chief post office up till eight o'clock, and the other two offices close, so far as telegraph business is concerned, at ten o'clock on week days and at half-past six on Sundays. It is understood that when the proposed extension has been carried out, representations will be made to the Postmaster-General that considering that Portsmouth has a population of no less than 140,000, the principal telegraph office should be opened day and night, the same as at Plymouth, and many other large provincial towns.

Commutating Alternating Currents. — Messrs. Gaulard and Gibbs, recognising the advantages possessed by continuous currents, have devised a little apparatus for changing the alternating currents employed by them into the same direction. It is composed of several electro-magnets connected in series and fixed to cast iron frame, a similar number of electro-magnets attached to a movable frame turning on its axis, a commutator fixed on the same axis, having as many changes of polarity as there are bobbins, and lastly of collectors receiving the currents. The alternating current traverses the fixed bobbins, and the point where the current leaves is attached to the brush which is in connection with the commutator; the opposite pole communicates with the other brush, and these brushes never come into contact with the same metallic pieces. If the apparatus is at rest, the movable electro-magnets are also traversed by the alternating currents, but as soon as the apparatus begins to work, the commutator inverts the poles of the movable electro-magnets. When the speed has become synchronous with the alternations, the current becomes continuous in the movable bobbins, and maintains the synchronism. A derivation on the collectors then gives a continuous current.

Electricity at the Inventions Exhibition.—The following compose the jury for Group 13 ("Electricity") at the International Inventions Exhibition: Prof. W. Grylls Adams, F.R.S. (chairman); Captain Abney, R.E., F.R.S.; Prof. W. E. Ayrton, F.R.S.; Viscount Bury, E. C. Cracknel, Colonel Festing, R.E.; Prof. George Forbes, M.A.; Dr. J. Hopkinson, Prof. D. E. Hughes, Prof. Oliver Lodge, D.Sc.; W. H. Massey, J. Fletcher Moulton, F.R.S.; C. E. Spagnoletti. Class 151, Group 28, "Electrical Apparatus," will also be referred to this jury.

Society of Arts.—The silver medal of the Society of Arts has been awarded to Mr. W. H. Preece, F.R.S., for his paper on "Electric Lighting in America."

The Royal Society.—On Wednesday evening a conversazione given by the Royal Society took place at Burlington House. About 250 or 300 ladies and gentlemen were present. They were received at the entrance to the principal room by Professor Huxley, the president of the Society. Many objects, scientific and mechanical, were displayed in the several rooms, and were inspected with evident interest by the guests as they passed from room to room. Among the mechanical contrivances which appeared to excite the chief interest was Tate's calculating machine, exhibited by the inventor, by means of which eight figures can be multiplied by eight figures in the space of about fifteen seconds. There were also many entomological and botanical specimens under microscopes exhibited, as well as samples of Edison incandescent lamps, exhibiting molecular shadows and transparent deposit of copper, and other electrical apparatus.

SS. "Dacia."—The ss. *Dacia* arrived in the Thames on the morning of the 7th inst., after having made a quick passage home from Key West. The ship sailed from England for Key West on the 2nd April, and during the fortnight she was in the West Indies effected the repairs of the 1869 Havannah-Key West cable. About 40 knots of the original cable was picked up, the core of which was found to be in good condition. This cable was stored at Key West for possible future repairs, and new cable was laid in its stead.

The Institution of Civil Engineers.—A *conversazione* was given by Sir Frederick Bramwell, President of the Institution of Civil Engineers, at the International Inventions Exhibition on Friday last week, by permission of the Executive Council. The weather was delightful, and the guests numbered about 12,000. Under such exceptional conditions it goes almost without saying that the meeting was a pronounced success.

Consumption of Electrical Energy in Glow Lamps.—With respect to a note bearing upon this subject, which appeared in our issue of May 23rd, it will be seen by reference to a letter in our correspondence columns headed "Slow Speed Dynamos," that an error arose in deciphering the figures in our correspondent's previous communication. The number of lamps there mentioned was in both instances 100 too many. The actual result arrived at is, however, much the same, for in the case of the Edison lamp 5¼ watts per candle-power are expended, whilst the Woodhouse-Rawson type required but 3 watts.

Freemasonry amongst Electricians.—We read in *Il Giorno* that an Electricians Masonic Lodge has been founded in London, the members including Sir Chas. Bright, Mr. W. H. Preece, F.R.S.; Mr. Graves, the chief engineer to the Post Office; Mr. C. E. Spagnoletti; and Mr. Fletcher, of the United Telephone Company.

Another Electric Railway in the States.—According to exchanges, a new electric railway, the invention of Prof. Short, of the Denver University, was recently given a practical test. The inventor claims for this invention that it possesses principles not used in the Edison and similar inventions. Prof. Short claims that his dynamo is superior to all others. Some time ago a company was formed to build a cable-car line in Denver, on which this invention is to be used, and already tracks are laid upon a number of the streets.

Hammond Electric Light and Power Supply Company, Limited.—Another has been added to the long list of failures in company electric lighting by the demise of the Hammond Electric Light and Power Company, at the age of three years. The company's directors are, according to the "Stock Exchange Year Book," Sir Charles L. Young, Bart. (who also figures as a director of 11 other companies), Mr. F. C. Barber, Mr. R. Hammond, Mr. F. Ince, and Mr. W. Low. The company was registered January 20th, 1883, to take over the electrical business of Mr. Robert Hammond, including a concession granted by the Anglo-American Brush Electric Light Corporation. Late in 1883 it absorbed the Birmingham and Warwickshire Brush Electric Light Company, the Yorkshire Brush Electric Light Company, and Ferranti, Thompson and Ince, Limited.

The Strauss Orchestra.—To the thousands who throng the Exhibition at South Kensington, this famous Viennese orchestra is doubtless the centre of attraction. Coming to this country with an extraordinary reputation, it is somewhat disappointing to musicians to find that these players have been very much over-rated, even in that department in which they necessarily most excel, viz., German waltzes, and dance music generally. Hitherto their performances have been held in one of the garden kiosks; but on Tuesday last, in order that Herr Strauss might have the opportunity of giving some of the finer portions of his *répertoire*, which were not well suited for open-air recitals, a concert was held in the Albert Hall, before an immense audience. The programme, with the exception of four short selections, was exclusively devoted to the lightest of ball-room and ballet music. The conductor evidently takes very moderate applause as a signal for a *bis*, so that in the majority of instances an *encore* piece was played; but we do not think that the efforts of the Strauss Orchestra on this occasion modified to any degree the almost unanimous verdict which competent judges have already passed upon this body of instrumentalists. The strings, especially the first violins, appear to us lamentably weak, and the short, snatchy style of bowing which Herr Strauss adopts whilst performing waltzes, eminently pretty in its way and for such a purpose, tells its tale when an attempt is made to give classical pieces requiring a *sostenuto* style of rendering. The balance of wind and strings is very indifferent; the latter, in *forte* passages for full orchestra, being, as little boys should be—seen but not heard. Again, to sensitive ears, the want of accord between the wood wind, and strings and brass, is at times painfully apparent; the piccolo being especially conspicuous in its excruciating sharpness. We think that the £6,000 paid for the two months' sojourn of Herr Strauss and his colleagues in this country might, so far as the cultivation of musical art in England is concerned, have been better employed in the organisation of a British-born orchestra, and it would have been by no means a difficult task to at once select a body of men of much superior calibre to those composing the Viennese orchestra. It is a question, perhaps—and here the Executive Committee is wise in its generation—whether such an arrangement would have proved remunerative; whereas any foreign band, however mediocre, is sure to attract the music-loving, but not discriminating, British public.

Bayley's Clutch Electro-Motor.—In our issue of May 9th we gave an illustration and description of this electro-motor, which receives its movement initially from a trembling bell arrangement of coils and armature, and it has been said that it is a more efficient piece of mechanism than the well-known Griscom apparatus. On experimenting with a motor of each kind we found, with a given battery, that the latter was far the more powerful of the two, but as the electrical constants of the respective motors were different, we did not attach any importance to the result, and therefore said nothing about it. We are therefore not a little surprised to find the following paragraph in a recent issue of a contemporary:—"For example, a pulley was fixed to the spindle of a Griscom motor weighing 2½ lbs. On connecting it with a battery of six good-sized bichromate cells, a weight of 3 ozs. was drawn slowly up; on connecting the same pulley and battery to one of these clutch motors having *four times the resistance** and weighing 2 lbs., a weight of 30 ozs. was lifted." To many persons this will be perfectly misleading, and we therefore protest against the circulation of such unfair statements, especially when a few words would have explained the different conditions under which the two motors were tested.

Extraordinary Absence of Mind.—Heard at the house of a subscriber to the Parisian exchange:—Office boy: Sir; some one calls you to the telephone.—Subscriber, to the apparatus: Hallo! Hallo! . . . . Yes. . . . . Oh! Pshaw! . . . . . Very well! . . . . Exactly. . . . . . Good bye.—Subscriber, to the boy: Edward, take care to remind me to-morrow of what these gentlemen have just told me.—*Bulletin International des Telephones.*

The Electrical Transmission of Power.—The silicium bronze cable, to be used between Criel and Paris, was tested this week, says the *Bulletin International des Telephones*, of the 8th inst., and it is proved that it will answer perfectly the conditions imposed upon the manufacturer. M. Marcel Deprez is constructing new machines, and the experiments are adjourned until the month of November next, the longest delay accepted at present by the Syndicate.

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* The italics are our own.—EDS. ELEC. REV.

Lighting of Mines.—A large party, by invitation of the directors, recently visited the Kaitanga coal mine in New Zealand, and we have been favoured with an account of the proceedings. That which will be most interesting to our readers is the fact that a temporary installation of the electric light was made as an experiment, to be rendered permanent if satisfactory. The electrical apparatus was lent by Messrs. R. E. Fletcher and Company, electrical engineers, of Dunedin, who no doubt anticipate reaping some advantage from the installation, inasmuch as the light appears to have pleased all who witnessed it. No detailed description is given, but there is a statement that, although the Kaitanga mine is one of the first in New Zealand to use the electric light underground, there are no less than fifteen gold mines and one coal mine in the Australian colonies electrically lighted; the system in some of them having been in successful use for nearly three years.

NEW COMPANY REGISTERED.

Buller, Jobson and Co., Limited.—Capital £108,100 in £20 shares. Objects: To carry on the businesses of engineers, telegraphic engineers, iron founders, metal workers and contractors; and to manufacture and generally deal in electricity and electric power, and all plant, machinery, fittings, and apparatus connected therewith. Signatories (with one share each):—*Howard Cochrane Jobson, Dudley, engineer; E. Percy Jobson, Dudley; *E. Wentworth Buller, Edgbaston; W. Stewart Forster, 28, Lincoln's Inn Fields; Major-General Redvers Hy. Buller, Downes, Devon; A. T. Buller, Greystoke, Cumberland; Wm. Greenhill, Birmingham; *J. T. Harris, Hanley, Stafford. Directing qualification 25 shares, or £500 stock. Registered 8th inst. by Messrs. Field, Roscoe and Co., 36, Lincoln's Inn Fields.

* Signatories whose names are preceded by an asterisk are also directors.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Gulcher Electric Light and Power Company, Limited.—An agreement, dated 8th ult., and filed on the 4th inst., cites that certain disputes and differences having arisen between the company and Mr. William Crookes, with respect to the purchase of certain patent rights, a compromise has been effected, and the company has surrendered the said patents to Mr. Crookes, in consideration of which 2,260 fully paid shares, held as follows, will be surrendered to the company. William Crookes 500, Ellen Crookes 500, Henry Crookes 480, Joseph Crookes 450, T. M. Morriss 220, J. H. Davidson 110.

Foreign Pilsen Electric Light and Power Company, Limited.—The statutory return of this company, made up to the 2nd inst., was filed on the 3rd inst. The nominal capital is £30,000 in £1 shares. 29,800 shares have been allotted and are credited as paid-up. Office, 11, Abchurch Lane.

Varley Electric Patents and Proprietory, Limited.—The statutory return of this company, made up to the 28th ult., was filed on the 3rd inst. The nominal capital is £40,000 in £5 shares. 2,561 shares have been allotted. Upon 100 shares, £5 per share has been called; upon 11 shares, £2 per share has been called; the remaining 2,450 shares being considered fully paid. The paid-up capital amounts to £12,772. Registered Office, Mildmay Park Works, Balls Pond, Islington, N.

Great Western Electric Light and Power Company, Limited—(In Liquidation).—The registered office of this company is now situated at 112, Belvedere Road, Lambeth.

Brush Midland Electric Light and Power Company, Limited and Reduced—(In Liquidation).—The registered office of this company is now situated at 112, Belvedere Road, Lambeth.

Pall Mall Electric Association, Limited.—The office of this company is now situated at 52, Oxford Street, W.

LEGAL.

Re the Companies Act and in re the Brazilian Submarine Telegraph Company.—(Sittings in Banc, before Mr. Justice Grove and Mr. Justice Denman.—Tuesday.)—This was an appeal from an order made by Mr. Justice Mathew at Chambers, under sec. 35 of the Companies Act, 1862, by which a remedy is provided for the rectification of any improper entry or the omission of any entry in the register of the members of any company. The facts in the case were shortly as follow:—Madame Chatenay, of Rio, was at the time of her death the registered holder of 50 shares in the Brazilian Submarine Telegraph Company. After her death in 1881, her son, Mr. Emilio Chatenay, instructed a Mr. Broe, resident in this country, to obtain letters of administration for him to his mother's estate. He sent Mr. Broe a power of attorney in Portuguese, by which, as appeared from the translation, he (Mr. Broe) was "especially to buy and sell shares of public companies and receive any dividends and to give receipts in conformity with his (Mr. Chatenay's) instructions." Mr. Broe sold the 50 shares in the usual way on the London Stock Exchange, and the transfers were signed by him in the name of Chatenay under the power of attorney which he held. Mr. Chatenay now denied that Mr. Broe had had any authority to execute the transfers, and he called upon the company to rectify their register by restoring his name to it as the holder of the 50 shares. They having refused to do so he had taken out a summons under sec. 35 of the Companies Act, 1862. Mr. Justice Mathew, confirming an order of a Master, directed an issue to be tried between Mr. Chatenay and the Company, and the latter appealed against that order. Mr. Finlay, Q.C., for the company, contended that they ought not to be forced, as they were by the order, to fight an issue in which they had no interest. The company did not object to the trial of an issue as to the registration of the 50 shares that had belonged to Mr. Chatenay, but they contended that it should be between him and the transferees. The Court dismissed the appeal, holding that upon the whole of the facts the trial of an issue was the best mode of deciding the question in the case, as it was clearly distinguishable from one in which two persons set up a claim against each other to be placed on the register of a company. It was just possible that the defendant company might have placed the names of the transferees of Mr. Chatenay's shares on their register without proper authority, and that question ought first to be decided. The matter was still left open to the company in the sense of their being able to bind those persons whose names were actually on their register as the owners of the 50 shares. In ordering that the company (the defendants in the issue) should be in the same position as if an action had been brought, Mr. Justice Mathew had reserved to them all their rights. Appeal accordingly dismissed, with costs.

CITY NOTES.

Hammond Electric Light and Power Supply Company, Limited.—A petition for the winding-up of this company is to be heard before Mr. Justice Kay on the 20th inst. On the application of Mr. Robinson, Q.C., Mr. Justice Kay, on Wednesday, appointed Mr. Theobald provisional liquidator of the Hammond Electric Light and Power Company, with authority to expend £200 a week on wages, &c., for continuing to execute the contracts of the company, one of which is the lighting of the Grand Theatre at Islington. Mr. Hammond, on whose behalf the application was made, has presented a petition for winding-up the company.

United Telephone Company.—The directors have decided, subject to audit, and after making ample provision for depreciation, &c., to recommend at the forthcoming general meeting a dividend for the second half-year ending April 30th, 1885, at the rate of 7s. 6d. per fully-paid share, part paid shares receiving in proportion, making with the interim dividend paid on December 2nd last, a total dividend for the 12 months ending April 30th last, of 10 per cent. per annum, carrying forward a substantial sum to the reserve.

Spanish National Submarine Telegraph Company, Limited.—The numbers are published of 57 Six per Cent. Mortgage Debentures, amounting to £5,700, which have been drawn for payment at par, at the offices of the company, 106, Cannon Street, E.C., on and after the 30th inst.

TRAFFIC RECEIPTS.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending June 5th were £2,402, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited.

The Great Northern Telegraph Company. The receipts for May, 1885, £28,800; from January 1st to May 31st, 1885, £118,000; for the corresponding months of 1884, £106,560; and of 1883, £100,360.

The West Coast of America Telegraph Company, Limited. The gross earnings for the month ending May 31st were £3,800.

NEW PATENTS—1885.

6786. "Indicating at sight the direction of electric currents." W. F. **Barrett**. Dated June 4.

6809. "Thermo-electric batteries." G. **Zanni**. Dated June 4.

6811. "Galvanic batteries especially applicable for portable electric table lamps and chandeliers." P. **Jensen**. (Communicated by K. Pollak and G. W. von Nawrocki.) Dated June 4.

6825. "Automatically regulating and controlling the speed of motors for driving dynamo-electric or other machines, and regulating electrical currents generated from any source." R. O. **Ritchie**, J. H. **Davies**. Dated June 4.

6826. "Leclanché battery for telegraphic and electrical purposes, and for public and household uses." C. A. **Grant**, T. **Hall**. Dated June 4.

6878. "Construction and arrangement of electrical batteries and devices or contrivances to allow of the emptying or withdrawal from, and the recharging of such batteries with the exciting fluids." J. T. **Armstrong**. Dated June 5.

6883. "Making cores of disc or ring armatures." F. **Wynne**. Dated June 5.

6887. "Integral meter of electric energy." F. **Saldana**. Dated June 5.

6918. "Dynamo-electric machinery." G. E. **Cabanellas**. Dated June 8.

6964. "Electric batteries." G. F. **Redfern**. (Communicated by J. B. Neyraud.) Dated June 8.

6971 "System of heating by electricity." N. **Frere**. (Communicated by A. Elu and E. Courcelles.) Dated June 8.

6994. "Smelting ores by an electric current, and furnaces or apparatus therefor." W. P. **Thompson**. (Communicated by E. H. and A. H. Cowles.) Dated June 9. (*Complete.*)

7010. "Means for signalling or telegraphing between railway trains or between trains and stations by induction." T. J. **Handford**. (Communicated by T. A. Edison and E. T. Gilliland.) Dated June 9.

7021. "Automatic electric lighting apparatus. C. S. **Snell**. Dated June 9.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1884.

6478. "Improvements in electrical signalling and stopping apparatus, chiefly designed for preventing collisions on railways." W. R. **Lake**. (Communicated from abroad by R. Snyers, of Brussels.) Dated April 17. 1s. The apparatus comprises conductors arranged along the railroad and divided into sections; an apparatus ensuring the permanent contact of trains with the said conductors; a contact breaker, which can be thrown into and out of action; a commutator, acting also as an interrupter; an apparatus acting automatically to stop the trains; and a switch for effecting the transfer of a train from one line to another, and acting as a commutator and as a contact breaker.

6736. "Improvements in the process of decomposing metallic haloid salts by electrolysis." C. **Hoepfner**. Dated April 23. 6d. Has for its chief object to prevent polarisation by using depolarising substances at the cathode, and by causing the electrolyte to be kept in motion.

7515. "Improvements in counters or apparatus for recording the passage of electricity in lamp circuits, and for other uses." **Sydney Pitt**. (Communicated from abroad by J. Cauderay, of Lausanne.) Dated May 9. 10d. The apparatus is an improvement on Patent No. 1756, 1883. The improved apparatus comprises the following parts:—There is a time-keeping arrangement consisting of a balance wheel with spiral spring, which is kept in movement so long as the current flows in the circuit by electro-magnets; the coils of these magnets form a shunt to the main or lamp circuit. These magnets alternately attract armatures attached to the axis of the balance wheel, and so keeping the said wheel in movement. The alternate transmission of currents through the coils of these magnets is effected by a regulator also upon the axis of the balance wheel. On the same axis there is also a cam operating a lever and ratchet arrangement in such a manner as to cause the rotation of a drum or cylinder once in each hundred seconds, or one revolution for every hundred double oscillations of the balance wheel. This drum or cylinder has projections upon it, as hereinafter more fully described. The current to be measured is caused to pass through galvanometer coils, and to influence a needle suspended between the pole pieces of a permanent magnet. These pole pieces are adjustable, and by means of them the regulation of the instrument can be effected. The needle is mounted upon an axis carrying also two light arms, one of these is simply an indicating finger, by the observation of which the deflection of the needle can be read upon a graduated arc. The other is a longer arm, and its end terminates in a metallic button, which is always in close proximity to the surface of the drum or cylinder mentioned above. When the needle is uninfluenced by any current passing in the circuit, this button stands in such a position in relation to the surface of the drum or cylinder, as to be clear of the projections thereon, but the deflection of the needle to one side or the other brings the button into the path of these projections. Thus, if the needle be deflected one degree, the button will thereby be moved to a position such that in one revolution of the drum or cylinder it is displaced once by a projection upon the drum or cylinder coming against it; in other words, it is thus brought into the path of one only of the projections which the drum or cylinder carries. If the needle be deflected two degrees the button is thereby brought into the path of two projections upon the drum or cylinder, and it is consequently displaced twice during each rotation. Similarly, if it be deflected three degrees, it is brought into the path of three of the projections, and so on. Each displacement of the button by the projections upon the drum or cylinder operates and moves forward by one tooth or step a ratchet, with which it is in mechanical connection. The ratchet carries round with it the first of a train of counting wheels. The mechanical counter consequently indicates and registers upon its dials the number of displacements to which the button controlled by the galvanometer needle is subjected during the time since the counting wheels were set to the zero point.

7624. "Improvements of electro-magnetic motors, and in the method of applying the current without reversals or changes of polarity." E. **Toynbee** and I. R. **Culley**. Dated May 13. 6d. The inventors affix upon one, two, or any suitable number of pairs of discs, each pair having one stationary and one revolving set of magnets—(usually termed armature and field magnets) the requisite number of electro-magnets, to make up one or more complete magnetic ring or rings—the number required being proportional to their size and to the periphery of the circle which it is desired to surround. The electro-magnets are in sets or series, so arranged that they cannot possibly act in any way prejudicially on one another. The electro-magnets occupying opposite sides of the revolving disc, and their corresponding stationary ones are magnetised in equal numbers at the same time, so that the lateral stress, which would otherwise be inevitable, should be neutralised. Only the attractive lines of magnetic force are utilised, so that there is no change of polarity or reversals. The sets or series of electro-magnets are magnetised in succession by the whole strength of the electric current for the period of time necessary to enable them to develop their maximum power, and that at the precise time when they are occupying their best relative positions for so doing, after which period of time or immediately prior to it, the next series are magnetised by the current being for an instant divided between the two sets—as may be thought most advantageous; in the latter case the electric current is continuous—little or no heat is evolved, and very trifling, if any, sparking at the brush takes place.

8077. "New insulating compounds for electrical purposes." A. **Muirhead**. Dated May 22. 4d. The new compounds are made by combining gutta percha with the substitution products which result from the action of chloride of sulphur or other similar re-agent upon any of the family of what are known as glycerides in organic chemistry.

8400. "Improvements in apparatus for controlling electrically the motion of steam or other engines." A. E. **Porte** and E. **Manville**. Dated May 30. 6d. Upon a suitable carriage are arranged two pairs of electro-magnets, each pair being provided with a pawl which engages in the periphery of a wheel mounted between the electro-magnets. This wheel acts on a screw in connection with the governing valve of the engine, in such a manner that the valve shall be opened or closed by the motion of said wheel. The carriage with the electro-magnets and attachments is kept oscillating about the wheel by an eccentric on the engine shaft, or other suitable means; and as the free ends of the magnet pawls are arranged to exercise a thrust on the wheel in opposite directions, it will be obvious that when either pawl engages the said wheel, it will rotate in the same direction as the pawl which engages it, and then acting on the screw connecting it with the governing valve, will open or close same, admitting a greater or less supply of the motor element to the engine. A tachometer, or other speed indicator, is fitted with two or more segmental contact plates extending a certain distance round the dial and separated from each other by a small space, representing one or two revolutions of the machinery to which the apparatus is to be applied. The index hand of the tachometer is then provided with a contact brush which plays on the segmental plates when the index hand is passing them. These contact plates, in conjunction with a suitable battery, are so connected up with the electric governor hereinbefore described, that when the index hand is in connection with the contact plate representing a speed *below* that desired, the current actuates the electro-magnet of the governor whose pawl engages the wheel in the necessary direction, to open the governing valve, the reverse taking place when the index hand comes into contact with the plate representing a speed *higher* than that desired.

8599. "Improvements in self-regulating electro-motors and dynamo-electric generators." W. M. **Mordey** and C. **Watson**. Dated June 4. 4d. The inventors wind the field-magnets of the motor with two wires, wound or connected in such a manner that the current passing through the wire of one coil assists the current passing through the wire of the other coil. They also wind the armature with two wires or circuits, not connected with one another in any way, but joined up to form two separate and distinct circuits, and each provided with a separate and distinct commutator or collector. One of these armature circuits occupies relatively only a small portion of the available space, and in some cases consists of merely a very few convolutions of wire. This additional armature circuit is connected by means of its commutator and contact brushes or springs or their equivalents, directly to the ends of one of the field-magnet circuits, the other field-magnet circuit being connected with the mains or other source of electric supply in the usual way, either in series with the main armature circuit, or as a shunt across it.

8654. "Improvements in transmitting motive power from electro-motors and apparatus therefor." C. P. **ELIESON**. Dated June 6. 6d. Relates to improvements in transmitting motive power from electro-motors and apparatus therefor, the object of the invention being to allow of the employment of an electro-motor for driving machinery, where the speed required is less than the critical speed of the motor itself, *i.e.*, the speed at which a maximum of work is performed with a minimum expenditure of current, this being effected with very little friction.

9340. "Improvements in electrical motors." J. H. **JOHNSON**. (Communicated from abroad by A. W. Adams, of America.) Dated June 24. 6d. Relates to improvements in the construction of electric motors suited to the propulsion of railroad cars and to the operation of light machinery of various kinds, for instance, sewing machines and dental instruments.

9116. "Construction and working of electrical apparatus for taking the readings of scientific instruments from a distance." H. B. **BOURNE** and H. R. F. **BOURNE**. Dated June 17. 6d. Relates to an apparatus by which the rise and fall of a float introduces more or less electrical resistance in a circuit. The measured value of this resistance represents the position of the float.

9163. "Improvements in apparatus for transmitting and collecting currents in electric railways." M. H. **SMITH**. Dated June 19. 10d. Relates to further improvements in apparatus for purpose aforesaid, for which Letters Patent No. 1014 were granted, dated the 24th day of February, 1883, and No. 5065, dated 24th October, 1883.

9412. "Improved apparatus for refreshing galvanic batteries." A. M. **CLARK**. (Communicated from abroad by A. Dun, of Germany.) Dated June 25. 6d. Consists of a simple means of refreshment whereby the emptying and filling up or adding to the battery may be effected without causing any interruption of the current.

9471. "Improvements in membrane telephones." S. P. **THOMPSON** and P. **JOLIN**. Dated June 27. 6d. Relates to the apparatus described in the No. of the **REVIEW** for May 9th, 1885.

9488. "Improvements in secondary batteries." A. **TRIBE** and A. P. **PRICE**. Dated June 27. 4d. Consists in the employment for the production of the foundation plates, frames, leads or supports of or for the positive element employed in such batteries of lead which has been to a greater or less degree converted into sulphides, arsenides, or phosphides, that is to say, either converted entirely or superficially. Plates, frames, leads or supports so prepared are employed as foundation plates, frames, leads or supports for the positive elements in secondary batteries.

9489. "Improvements in the construction of secondary batteries." A. **TRIBE**. Dated June 27. 2d. Consists in the employment for what are known as leads used and employed in the construction of secondary batteries, which leads are connected with the active material forming the negative element constituting one element of secondary batteries. The inventor employs as leads, lead which has been either entirely or superficially converted into lead sulphide, phosphide, or arsenide, by one or other of the processes described in Patent No. 2,263 A.D. 1882, or other processes may be employed.

9674. "Improvements in telephonic receivers." J. H. **JOHNSON**. (Communicated from abroad by P. G. Skrivanow, of Paris.) Dated July 2. 4d. According to this invention a magnet is provided forming the holder of the receiver, and consisting of two or more leaves, plates or parts, placed side by side and connected at their poles to a plate which forms the base plate of the box or receptacle which contains the two bobbins which are carried one by each of the poles of the magnet. The coils of these bobbins are connected and led to the respective terminal screws of the external wires, the said terminal screws being also carried by the aforesaid plate. The diaphragm is secured by a cap which forms the cover of the instrument, and has the orifice in it by which the sound issues from the apparatus.

9735. "Improvements in secondary batteries." W. **TAYLOR** and F. **KING**. Dated July 3. 4d. The inventors construct electrodes for secondary batteries of flat rings or a helix, or helices of lead, so placed or wound as to form a cylinder or cylinders the size and number required to give the requisite capacity to the cell. The said rings or helices are so placed, wound or formed, that they afford spaces between them for the packing of the active material.

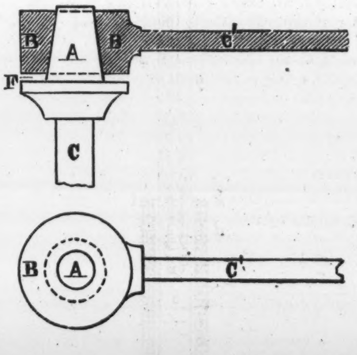
9756. "Improvements in producing sulpho-colouring matters by electrolysis." E. **CAPITAINE**. (Communicated from abroad by Ewer and Pick, of Berlin.) Dated July 4. 6d. The invention is based on the following observations:—If two plates of platina which constitute the two poles of an electric generator are immersed in a solution of sulphide of hydrogen of Paramidodimethylaniline in diluted sulphuric acid, an active development of hydrogen is to be observed on the cathode (negative pole), while the fluid around the anode (positive pole) is getting blue. This blueing ceases, however, in a short time, and the platina plate of the positive pole becomes covered with a grey coating. If the platina plate is cleaned by means of a small brush or otherwise of this grey coating, the blueing begins again, ceasing, however, after a short time. If this cleaning of the platina plate by the brush is continued, so that the platina is kept bright, then in a little while, under continuous evolution of hydrogen at the negative pole, the whole of the sulphide of hydrogen disappears from the fluid, and the fluid commences to take a blue colour. The fluid now contains chiefly methylen white in solution. Upon continuing the electrolysis the fluid continues up to a certain point to become a darker blue colour, at which point the deepening of the colour ceases.

10054. "Improvements in the composition of materials to be employed in protecting and insulating wires, and for other insulating purposes." A. **PARKES**. Dated July 11. 4d. Refers to the employment of resin, whether dehydrated, bleached, purified, or otherwise, in combination with castor oil, linseed oil, or cotton seed oil, or other drying oils, whether oxidised or not, and also of paraffin or of ozokerit, Japan or vegetable wax, one or more of these in comparatively small proportion with resin or resins so as to render the insulating material less brittle, and at the same time to make it a more perfect insulator or protector of the telegraphic or telephonic wire or other form of conductor.

10207. "Improvements in secondary voltaic batteries, applicable also to single fluid primary batteries." C. **MOSELEY**. Dated July 16. 6d. The inventor interposes separators between the plates or electrodes of the battery. These separators are so constructed as to maintain the required distance between the plates and to prevent contact. They may be made of any suitable material, such as gutta percha, celluloid or hard vulcanised India rubber.

10919. "Improvements in apparatus for making and breaking circuits in connection with the charging and discharging of secondary batteries." J. S. **BEEMAN**. Dated August 5. 6d. Relates to an arrangement or combination of, firstly, any well known or suitable contact or circuit making and breaking apparatus, actuated by gas pressure, the gas having been collected after being given off from one electrode, or more, of a secondary battery; and, secondly, of an apparatus controlled by an electromagnet actuated by the rise and fall of the E.M.F. of one cell, or more, of a secondary battery, whereby the first apparatus cannot, after breaking the circuit, establish it again until the second apparatus has, through its action, either allowed the gas to escape, or removed the obstruction interposed through the action of the first apparatus.

10923. "Improved electrical connector." J. S. **BEEMAN**. Dated August 5. 4d. Has reference to an improved electrical connector or method of connecting two metallic portions of a circuit, by means of one portion being shaped as or fitted with a male truncated cone, and the other portion being shaped as or fitted with a female truncated cone, the tighter the male cone is pushed into the female cone the better being the contact. The fig. is a plan view part section and elevation of one form of connector made according to the invention, one portion of the circuit, C, being shaped as or fitted with a male cone, A, whilst the other portion, C^1, is shaped as or fitted with a female cone, B.



11362. "Improvements in the production of materials capable of being employed for protecting and insulating purposes." A. **PARKES**. Dated July 11. 2d. Consists in the employment of the following combination of materials for insulating or protecting telegraphic or telephonic wires or other forms of conductors of electric or magnetic currents in about the proportions hereinafter mentioned, viz., from about 90 lbs. of asphaltum (by preference Egyptian or Persian) or other good hard pitchy matter from about 5 lbs. to about 10 lbs. of boiled linseed oil or of castor oil or cotton seed oil.

12445. "Improvements in the means of effecting communication in telephonic systems." L. J. **CROSSLEY**, J. F. **HARRISON**, and W. **EMMOTT**. Dated September 16. 4d. Relates to certain improvements in the means whereby a communication can be effected in ordinary telephonic systems. By depositing into a suitable receptacle a coin or voucher or an authoritative representation of such coin, the latter or its equivalent makes contact or closes a circuit.

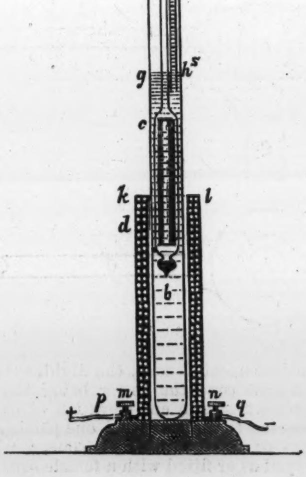
13266. "Improvements in printing telegraphs." W. P. THOMPSON. (Communicated from abroad by C. G. Burke, of America.) Dated October 7. 10d. The object of the invention is to provide means for transmitting upon a single main line conductor electric impulses adapted to actuate the type wheels of a printing telegraph instrument located at a distant station, and to so organise the apparatus that a single message may be transmitted, or, when it is so desired, impressions may be taken from either of two type wheels at will, and in such a manner as to constitute two distinct records, the operation of transmitting and receiving two messages being carried on at the same time. A further object of the invention is to provide means whereby the dispatch or dispatches which it is desired to transmit, may, if it is so desired, be recorded upon a transmitting cylinder in such a manner as to render them capable of being automatically transmitted therefrom if desired.

13637. "Improvements in telegraphic translators." W. E. GEDGE. (Communicated from abroad by J. Kölzer, of Germany.) Dated June 14. 6d. Relates to a new arrangement in a telegraphic line with two Morse relays, by means of which a working current may be converted into a continuous or permanent one and *vice versa*.

14008. "Improvements in electric guns." S. RUSSELL. Dated October 22. 6d. Relates to guns or other fire-arms, which are adapted to fire electric cartridges, particularly those cartridges which are constructed with a small electric conductor of high resistance, usually a fine platinum wire arranged in contact with the powder, which conductor, upon the passage through it of a sufficient electric current, is heated to incandescence and ignites the powder.

15875. "Improvements in electric bell pushes, contact-makers and indicators." W. A. LEIPNER and C. BROTHERHOOD. Dated December 3. 4d. The improvements consist of a solenoid movement operating a needle or pricker or section of a knob of an electric bell push in a similar manner to the operation of those shown in the figures of former complete specification bearing date 1st July, 1884, and numbered 9607.

16175. "Improvements in apparatus for measuring electrical currents." F. P. E. DE LALANDE. Dated December 9. 6d. This apparatus is intended for the measurement of electric currents, and is composed of an areometer, *a*, *b*, having the same general shape and appearance of ordinary areometers, but in the cylindrical floating portion of which a thin tube of soft iron, *c*, *d*, is encased. This areometer floats in a glass vessel, *e*, filled with liquid up to a determined level, *g*, *h*. The lower part of this vessel is surrounded by a coil, *k*, *l*, *m*, *n*, wound with an insulated wire and the extremities of which are connected with the terminals, *p*, and *q*. The level of the liquid is determined so that the lower part of the soft iron tube enters the coil a certain distance, always the same when the current does not pass through the apparatus. If a current passes through the coil, the soft iron tube being vertically attracted the areometer sinks a certain distance which is invariable for a given current. A mark, *a*, being made in the higher part of the areometer's rod the downward motion of the areometer can be estimated by the position taken by the said mark, *a*, on a fixed scale, *r*, *s*, with which the glass vessel is provided.



AMENDMENT.

4847*. November 28, 1878. "Electric lamps." F. J. CHEESBROUGH. (Communicated from abroad by W. E. Sawyer, of America.) Amended by J. Y. Johnson. Dated May 16. 10d.

CORRESPONDENCE.

Slow Speed Dynamos.

Finding some false prints in my notice on slow speed dynamos, for which you have kindly opened the columns in the REVIEW of 23rd ultimo, I should feel much obliged if you, the earlier the better, would please to correct the following errata, apparently arising from misinterpretation of some 2's in the M.SS.

The results of the mentioned experiments were :—

"1. The field magnets in shunt, but the whole shunt in one circuit : 460 revolutions, 110 volts, 190 ampères = 250 (two hundred and fifty) Edison's 16 C.P. A. lamps.

"2. The field magnets in shunt, but in two parallel circuits : 260 (two hundred and sixty) revolutions, 60 volts, 200 ampères = 200 (two hundred) Woodhouse-Rawson 20 C.P. lamps."

Ludv. Fredholm.
Managing Director,
Elektriska Aktiebolaget, Stockholm.

June 3rd, 1885.

Protection to Workmen.

I would make a suggestion which may prove of value to a certain class of mechanics who have to deal with dynamos giving very high E.M.F. The danger of touching two parts of such machines at the same time, if such parts have a large difference of potential, is unfortunately too well known. It is an error to suppose that touching such machines with one hand will produce no ill-effects. This will only be the case when the skin is perfectly dry, or the floor a non-conductor, in those cases where there is a "leakage" on the "opposite side" to the part touched. It may be taken for granted that bad insulation somewhere is almost certain to exist in cases of very high E.M.F. being used, and, therefore, it is always dangerous to touch any exposed portions of the circuit.

To avoid bad result from such want of caution, a simple remedy exists, viz., India rubber soles to the boots (or any non-conducting substance), which would have the effect of "cutting off earth" and avert the danger.

David Salomons.

London, *June 5th*, 1885.

[The suggestion of Sir David Salomons for using an India rubber protection has been made times without number, for hands as well as feet, but without avail. There are, of course, certain disadvantages attending the use of gloves, for a workman whose hands are thus covered is not so well able to handle anything he requires to manipulate ; and India rubber soles to shoes are not, in a hot place, very desirable. Still, we should be glad to see such suggestions more generally acted upon, for without doubt several valuable lives might thereby have been saved.—EDS. ELEC. REV.]

Jolin's Electric Bell.

In your issue of May 30th you give a description of Jolin's electric bell. A simple and excellent bell, answering to the same purposes, has been invented years ago by Dr. H. Schellen, and is described in his well known book, "Der Elektro-Magnetische Telegraph," fifth edition, p. 712. These bells can be worked in series in one circuit, give no spark, and no appreciable induction on neighbouring telephone lines. They are, moreover, as cheap and simple as the ordinary trembling bells. I send you by the same post an extract from *De Natuur*, in which you will find a sketch of Schellen's bell.

J. W. Giltay.

Delft, *June 3rd*, 1885.

[We thank Mr. Giltay for his courtesy, and have made a translation of his paper, which will be found in our other columns.—EDS. ELEC. REV.]

Cardew's Voltmeter.

I notice that in your last issue you appeal to me for an explanation of a discrepancy of reading in one of my voltmeters at a certain point of the scale, when the same volts are measured by a reading ascending from zero or descending from 100 volts.

I assume, as is most probable, that the volts in the two cases were really the same.

You appear to think the phenomenon may be due to some inherent defect in the nature of the instrument, analogous to the effect of residual magnetism in an instrument depending on the pull of an electro-magnet, or the heating of the copper wire of a magnetic coil.

From my experience of these instruments, and conception of the theory of their action, I do not consider this likely, and think the most probable solution is that the discrepancy is due to an excess of friction at the pivots, or possibly to the pointer slightly touching the dial at the 93 volt mark.

In some of the commercial instruments the pivots of the pulley at the top of the tube were not jewelled; and I have detected errors evidently due to friction in these.

The makers, who are always ready to adopt any practical suggestion, now jewel all the pivots.

I think it probable that a smart tap would cause the readings to coincide; but, if not, would suggest that the instrument should be sent back to the makers for examination. For standard purposes, I employ a form of instrument in which there is no friction, and in which no such discrepancy of reading has ever been observed.

I shall be glad to show this instrument to any electrician who cares to see it.

P. Cardew.

Chatham, *June 8th*, 1885.

[We thank Captain Cardew for his remarks, and doubtless the owner of the instrument to which we referred will take steps to ascertain the cause of apparent error which has been noticeable at other parts of the dial between the 90 and 110 volt marks.—EDS. ELEC. REV.]

Secondary Batteries.

The remarks of Prof. J. Trowbridge in reference to the durability, &c., of accumulators, are, I have no doubt, based on the 1881 form of Faure cells, the description of which he very truly states. To compare this description with cells of the present time would be similar to comparing the machine of Otto Guericke to that of Voss or Wimshurst. The important fact, *i.e.*, that it is necessary to have a practical method of storing or converting electrical energy was fully realised by a few about five years back; and, I may say, some of the few have been constantly at work on this very interesting subject with a fixed determination. The results are, the difficulties which appeared so conflicting and fatal have to a very great extent vanished. It is quite possible at the present time to construct accumulators that *can be depended upon* and have an average life of three years; and, where weight is no object, much longer. We have good reasons to expect that this will be considered a very short life in the immediate future, if we take into consideration the comparatively few who have devoted their time, &c., to this very necessary means of using natural sources of power. We must come to the conclusion that great progress has been made. What I say are facts which I have practically proved. I cannot give my experience of any particular form of cell, as it might be taken for advertisement. The suggestion I should like to make to those who have not mastered the *elements* of a secondary battery, and are unacquainted with the progress made, is to obtain one or a set of the latest form and compare notes.

H. A. Kent.

June 8th, 1885.

Jolin's Electric Bells.

Referring to the letters of your correspondents in your issue of 6th inst., we beg to say, as owners of Jolin's patent, that the method mentioned by them of using one trembling in series with a number of single stroke bells is, as you justly remark, not new, and has two great defects, which in our system are avoided.

Firstly, the old method requires large battery power; and, secondly, as the break occurs at the interruption of the master bell only, there is produced at that point of the circuit a very strong spark, which rapidly destroys the contact points if many bells are worked on the line; for it is evident that the electromotive forces of the extra currents of all the bells are added up into one great electromotive force at the single interruptor, if all the bells strike with simultaneous strokes. In our system, not only are the bells independent of one another in their striking action, but by the very construction adopted each bell neutralises its own extra current, and there are no extra current sparks at any of the contacts.

Your correspondents have evidently overlooked these points, or they would not have written as if non-sparking were of no advantage. The new method allows any size of bell to be worked in series, although their rates of vibration are widely different. The cost of manufacture also is much less than that of ordinary bells, and as the various bells in the series will not be taking energy from the current at the same instant, the number of cells required to actuate a number of bells becomes less in proportion per bell the larger the number of bells in series, thus effecting a considerable saving in large circuits. We observe that none of your correspondents have yet had any practical experience of our bells, and therefore we can make allowance for their not yet recognising the real and substantial improvements which we have effected.

P. Jolin & Co.

Electrical Engineers, 35, Narrow
Wine Street, Bristol.

The "New" (?) Telephone.

I am grieved to have once more to intrude upon your space for the purpose of disturbing the complacency of your correspondent, Mr. T. W. Barnard, but I cannot allow the misleading interpretations that he puts on the statements contained in my letter of the 23rd May to pass without notice, though in most cases his misrepresentations are so obvious as to be positively entertaining.

First, as regards Prof. Thompson's magnet arrangement and the question of its novelty, I would point out that I did not state, as Mr. Barnard would have you believe, that *none* of Phelps's telephones had concentric poles, but only that the "pony crown" instrument mentioned by Mr. Barnard in his letter of May 30th was not fitted with this arrangement, which is undoubtedly a fact, as witness Hospitalier, Vol. II., page 31. Whether or no D'Arsonval was the first to employ concentric poles is a matter of no importance, as it is entirely outside the point at issue, for Mr. Barnard allows the truth of my contention that the arrangement is not new, which was all that I claimed. This apart, moreover, the fact remains that the D'Arsonval arrangement of magnet and pole pieces is similar to the one employed by Prof. Thompson.

Whether the one pole entirely or only partly surrounds the other does not appear to be a point of any moment whatever, but if I were asked to give an opinion on the matter, I should say that of the two arrangements Prof. Thompson's is probably the least efficient, though the difference would be for all practical purposes inappreciable, unless the slot or division in the outer pole was of great width, when the "new" arrangement would become very much inferior to the other.

I would, however, point out that the employment of split pole pieces is not itself novel, as Phelps employed them in one of his telephones (see Du Moncel on the telephone, English edition, page 119.

As regards the membrane, I must again find fault with Mr. Barnard for distorting the obvious, and, in fact, the only rational meaning, that can be attached to my words.

I never gave it as my opinion that *a* membrane cannot be used without infringing Eldred's patent, as such a statement would be manifestly absurd. What I did say was, that *Prof. Thompson's membrane arrangement*, as described in his specification, comes under Eldred's patent, and I am confident that anyone examining the two specifications in an impartial spirit would come to the same conclusion, for as pointed out in my letter there is practically no difference between the two.

The magnet of Prof. Thompson's instrument is undoubtedly quite distinct from that of Eldred, but as the latter claims his membrane arrangement by itself, the altering of the magnet will not prevent an infringement.

Mr. Barnard does not seem to think my strictures regarding the "plug" arrangement as worthy of refutation; or is it that he finds them to be irrefutable? Perhaps it will be news to him that it is quite possible for a *local* battery to be in the *main circuit* or *line wire*, yet such, however, is the case.

Prof. Thompson's "plug magnet" is merely a *dodge* (I know no better or more scientific expression for it), in order to effect this without waste of power.

A very much neater, more practical, and more scientific arrangement for the same purpose is one invented by Anders, whose patent has passed with Eldred's into the possession of the United Telephone Company.

In it the plug magnet is replaced by a second receiver, and the batteries are balanced so that nearly all the battery current flows in the local circuit through the receivers, and practically none through the line; yet as in Prof. Thompson's arrangement both batteries and receivers are in the main circuit or line wire.

Mr. Barnard, in his comparatively short letter, contrives to make so many misrepresentations that it is weary work pointing them all out. I would ask him to quote any words of mine that can be construed as meaning that three Leclanché cells cost more than a magneto call instrument.

I remarked, it is true, that where magneto bells are employed—and as they are employed very largely in telephonic exchange work I presume that they have definite advantages—that the additional cells necessitated by Prof. Thompson's arrangement would add largely to the cost of maintenance of the instruments. This is strictly the case; and in a telephonic exchange the cost of maintaining say 3,000 instead of 1,000 cells will be by no means insignificant.

I leave it to the impartiality of your readers to say whether it is Mr. Barnard or myself who indulges in reckless statements, and is afflicted with obliquity of vision, and in the interval not being in need of a gratuitous advertisement for myself, I shall be bold enough, in spite of Mr. Barnard's anathemas and objection to the epithet, still to subscribe myself as a

"Telephonist."

June 8th, 1885.

Technological Examinations, 1885.

Prof. Ayrton's questions, as printed in your issue of last week, are much better selected and put than formerly; yet some of them in the "pass grade" are too difficult for apprentices and workmen, for whom the examinations are professedly intended?

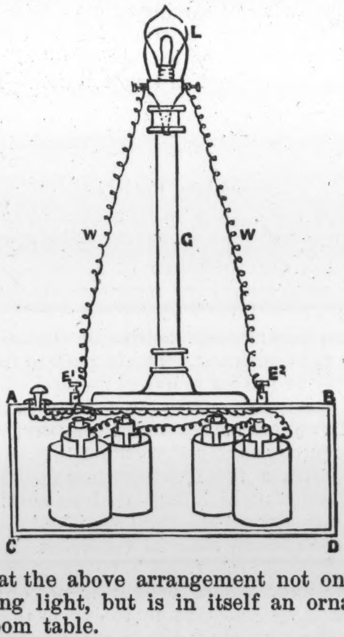
It would certainly do much to encourage students to come forward in greater numbers to these examinations if the "pass grade" was made a little easier in future, still keeping up the present high standard of the "honours grade." At present there is very little difference between the two grades. The Professor may not know (but nevertheless it is the case) that it is next to impossible in the provincial towns to get together a class composed of those who are actually engaged in electrical engineering work, for they are kept so busy during the winter evenings erecting or running installations, that they cannot attend between the hours of 7 and 10 p.m., the hours most convenient to other evening students. It is therefore principally those who wish to become in the future electricians or electrical engineers who attend the evening classes, and who probably have never handled a dynamo or tested a lamp before coming to the class, and are therefore completely ignorant of the subject at the beginning of the session. To actually teach (without cramming) such material sufficient to pass such an examination, as you printed last week, in some thirty lectures, is no easy task. In the case of Telegraphy, and many of the other City and Guilds subjects, it is quite different. The men who come to the classes have for years been practically engaged in practising the art, the science of which they may now wish to understand; and therefore the average material is much better in proportion to the difficulty of the subject.

I herewith enclose the Telegraphy paper. The name of the examiner is not given. It used to be Mr. W. H. Preece, F.R.S.; but if so again, he has also given about as difficult a paper for the pass as for the honours grade, and the very wide range of his questions is considerably beyond the average Post Office telegraphist, who forms by far the largest portion of the competitors.

Honours.

Drawing-room Electric Light.

A, B, C, D, is a rosewood box large enough to hold four B Bunsen's cells. S is the switch fixed to the top of the box. L is a 5 C.P. incandescent lamp mounted on a glass pillar, G. E^1, E^2, are binding screws. W, W, flexible wire covered with blue silk connecting lamp to the binding screws. The positive of the Bunsen cell on the left hand is connected to the binding screw, E^1. The zinc of the fourth cell is connected to the binding screw, E^2. The binding screws are then connected to the respective ends of the switch.



I find that the above arrangement not only gives a good reading light, but is in itself an ornament to a drawing-room table.

At the sides of the box are fixed two brass sunk handles for convenient to carrying the apparatus about.

The bottom of the box is removable, and secured to its place with hooks and eyes.

A slight glance at the arrangement will enable any amateur to make the apparatus for himself at a very moderate cost.

J. Jerritt.

Associate to the Royal Society of Telegraph Engineers and Electricians (Lon.).

Plymouth, *8th June*, 1885.

[As our correspondent has drawn his connections the battery is short circuited when the switch plug is in. We are not acquainted with the society to which Mr. Jerritt belongs.—EDS. ELEC. REV.]

PATERSON & COOPER,

ELECTRIC LIGHT AND POWER AND TELEPHONE ENGINEERS,

ST. PAUL'S WORKS—76, LITTLE BRITAIN, LONDON, E.C., AND
EUROPEAN TELEGRAPH WORKS—POWNALL ROAD, DALSTON.

Prize Medals, International Electrical Exhibitions, Paris, 1881, London, 1882, and Calcutta, 1883.

MANUFACTURERS OF

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